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Annual Report

OF THE SECRETARY OF THE INTERIOR

1945

ANNUAL REPORT

OF THE

SECRETARY

OF THE INTERIOR

FISCAL YEAR ENDED JUNE 30 1945

UNITED STATES DEPARTMENT OF THE INTERIOR

Harold L. Ickes, Secretary

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LETTER OF TRANSMITTAL
THE SECRETARY OF THE INTERIOR

HAROLD L. ICKES, *Secretary*

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My Dear Mr. President: This annual report seeks to show how the mobilized resources of this Nation contributed to victory over the Axis nations. It also reveals how near that victory came to being a Pyrrhic one.

At the beginning of the period here covered we were still searching the earth for the minerals that were needed in ever-increasing quantities to equip our own fighting forces as well as those of our allies. While we were searching for these minerals with meticulous diligence we were spending them with wanton prodigality.

By the end of the period of this report our natural resources had been tapped, processed and sent to the battlefields in such prodigious quantities that Nazi Germany already had collapsed, and Japan was about to do so.

But the drain on our national natural assets had been staggering. Only nine of the major minerals remain in our known domestic reserves in great enough quantity of usable grade to last 100 years or more. Our known usable reserves of 22 essential minerals have dwindled to a 35-year supply or less. Our assured domestic deposits of petroleum would last from 14 to 20 years at our present rate of use, but our prospects of making good on some of our losses in oil are fairly good.

In some other fields of conservation, the damage of war has been just as real, though it may prove to be temporary, and certainly it has been less severe. We were obliged to complete our huge power-production facilities ahead of schedule to energize war plants where there was no comparable peacetime manufacture to sustain the plants after the war. We must find new markets for those facilities or suffer the consequences of unemployed power which is scarcely more healthful economically than are unemployed men.

The war has reduced much of Europe and Asia to such a shambles, physically or economically or in both respects, that great populations abroad cannot provide the essentials of existence for themselves.

But they must be maintained so that, if for no other reason, they can sustain our economy. We must provide these peoples with as many of their needs as we can provide, especially food. We equipped ourselves during the war to produce more food, but not enough more to meet the postwar demands at home and abroad. The inadequate expansion of our agriculture is just as certainly attributable to the war as is the increased demand for food. We had to put as little material and work as possible into irrigation facilities so that we could put as much as possible into dams and power plants that would produce fighting equipment.

It is only fair to interrupt this gloomy recital long enough to say that some advantages, aside from military victory, also came our way between the beginning of the war and my transmittal of this report. The danger of defeat sped our improvement of new methods of exploring for mineral deposits, and for processing ores.

We have acquired jurisdiction over the Continental Shelf, which is about 760,000 square miles of underwater land from which we may replenish some of our depleted mineral reserves. Other Federal agencies have discovered or improved certain techniques and devices, radar among them, that will enable us to explore the shelf and to extract its riches more quickly than we could have hoped to do had science developed at its peacetime pace. We have several advantages in the programs which this Department formulated for the express purpose of regaining our balance in conservation after victory. We have begun an accounting of the minerals that we still have in our reserves, and when the tally is complete it will be as valuable to us as a clear statement of its assets would be to a corporation. We have made studies that show what the prospects of sucesss are for various industries that might buy and use the power that we produce when war contracts are cancelled. These studies, which were made in cooperation with other Federal agencies, States, municipalities, colleges and industries, tell prospective contractors for our power which raw materials would be available to them, in what probable quantities, at what probable prices, what markets they might expect, and many related facts which may hasten the sale of power by facilitating the prospective buyers' preliminary surveys. We have already contracted for the sale of some power and the outlook for additional contracts is not discouraging. Within the past fiscal year, also, we have made much headway toward achieving regional development.

This is about as accurate as so brief a statement of our principal gains and our principal losses could be, but we cannot use it as a balance sheet. The losses that are listed are indeed losses; the ores that we have taken out of our mines will not creep back into the ground, but the "gains" are not so conclusively gains. Oil deposits in the Continental Shelf remain an unknown factor. We will have to make a survey to find them. Processes for beneficiating low-grade ores will not, of their own accord, extract an ounce of metal, and many of the other "gains" that I have listed are equally inconclusive. They are merely potential gains. We can use them to our advantage or we can let the opportunity to use them escape us. I hope that a more detailed view of what is left of our diminishing resources will convince all of us that we must make amends for our losses by squeezing the last drop of advantage out of every potential gain that we have at hand.

The nine minerals that are plentiful enough in our known domestic reserves to last 100 years or more at a normal rate of use, are iron ore, nitrogen, magnesium, salt, bituminous coal and lignite, phosphate rock, molybdenum, anthracite, and potash. There are only nine of them out of the long list of metals that we must get at home or abroad in quantities as great as we need in order to hold our high place among the nations.

Even if we had a hundred years' supply of all of the metals that we need, that would not mean that we would be safe for a century. In the games of war and trade which nations play, a century is only a little while. Military and economic campaigns have been planned that far ahead. Consequently, it behooves us to learn the true meaning of our meager supply, which is not that we will be weak in a hundred years, but that we are relatively weak now.

Neither does the possession of a particular metal in great quantity guarantee that we can have all of the products that can be made of that metal so long as it lasts. We must have, in addition, the alloys that go into those products. Manganese is just as important as iron is in the making of most steel, and we have only a 2-year supply of usable manganese ore in our proved domestic reserves. So are vanadium and tungsten as necessary as iron is in making certain steels that are essential in time of peace or war; but we have in our proved domestic reserves only a 7-year supply of vanadium, and a 4-year supply of tungsten. We have less than a 35-year supply of 19 other minerals; among them, petroleum, copper, lead, tin, zinc, nickel, bauxite, chromite, and cadmium. Our reserves of high-grade coking coal are low. We do not know just how low because our knowledge of reserves is not yet so extensive as it should be. Our highest-grade iron ore, the kind that can be mined and smelted most cheaply, would be exhausted in about 22 years at a normal rate of use.

The past has not taught us how severely we can be penalized for a lack of metals at the outbreak of a war. It has taught us only that such a dearth can put us to a severe test. That is the worst that has happened to us; because we have always had time between the threat of war and actual war to get the materials which we lacked, or to find substitutes for them. But we cannot henceforth count on any appreciable lapse of time between the threat and the event of a war.

Neither has the past taught us how terribly we could be made to suffer, from a scarcity of minerals, even in time of peace. We have never had to use substitutes for the commonest metals, nor have we paid unbelievable prices for such necessaries as automobiles and refrigerators. But that is what we would have to do if we used the last of our high-grade ores, and had to import metals over great distances or extract them from our own submarginal reserves. Transportation of heavy goods is costly. So is the treatment of low-grade ores, and the consumer would pay the cost. I think that most Americans would like to see us take preventive measures against these threats while there is still time and I urge the necessity for it.

Many of the measures that would conserve the minerals that we have, or give us access to a larger supply, are very well known. We should stockpile; that is, we should import emergency supplies of metals that are scarce here, and store them, and we should add to that reserve from our own surpluses whenever we produce metals in greater quantity than we use them. We should intensify our explorations for new reserves. Improved instruments and methods would make our explorations effective and relatively cheap.

We should intensify our experiments in extracting metals from low-grade domestic ores by means of new and improved processes. If we wait until our high-grade ores are gone, and only then begin to use those of low-grade, processing will be very costly and uncertain of profitable results. If begun in advance of actual need, most experiments are not gropings after undreamed of methods. They are, instead, very practical proceedings by which well-known laboratory methods are improved enough eventually to make them profitable in large scale production. There is no mystery about how to make synthetic gasoline, for example. We can make it now, but the processing costs about 15 cents a gallon. Gasoline can be made from crude oil by means of a process that costs only about 5 cents a gallon. If we should drop our experiments in making synthetic motor fuel, and begin to produce it after our petroleum had vanished, by the methods which we know, every motorist would have to pay for a process that would be three times as expensive as that now in use. We should continue our experiments in all of our processes for beneficiating low-grade ores for the same reason that we should continue our experiments with synthetic gasoline—so that they will be cheap enough to use when we have to use them.

We should also find more efficient methods of reusing scrap metals, find out how we can induce operators to take more oil from nearly dry wells, and act accordingly. We should regulate production methods so that waste in the process of mining will be minimized, and we should do all that we can do to prevent the unnecessary use of our scarce and essential reserves. Our continued waste of natural gas is inexcusably profligate. Another case in point is coking coal, now being used where ordinary coal would be adequate, and which should be reserved for steel making, in which it is essential.

Above all we should act upon the advice of competent researchers, scientists, and technologists whose official business it is to keep us informed about which minerals we need and how to get them. No list of critical and strategic metals can remain accurate very long. A new alloy becomes indispensable, an old one becomes passe, a foreign source of supply becomes more accessible to us, and another becomes less so. Consequently, we cannot formulate any policy which would be applicable at all times and on all occasions.

The measures that I have recommended would help us to strengthen our position, but two other programs that are under way in this Department almost certainly will add more to our wealth and conserve our resources more effectively than any measures would that I have discussed thus far. These are a program for regional development and another for the exploration of the Continental Shelf. The concept and theory of regional development were discussed recently in hearings before a Senate committee, and these preceedings were published. Some of the facilities that could be administered in developing the resources of the Missouri Valley are under construction, and we are making studies that may result in the full and coordinated development of 14 other great river basins. News of these activities has been published, too. Consequently, there is relatively wide-spread understanding of what regional development is, of what is being done about it, and what it is intended to accomplish. But there has been almost no discussion of our impending exploration of the Continental Shelf, one of the Nation's most important acquisitions. If we discount the obvious fact it is uninhabited and uninhabitable, the Continental Shelf ranks with the lands which we acquired by the Louisiana Purchase, or by the opening of the West, or by the purchase of Alaska. And the exploration of this vast underwater area will be an important historical event. We will make new applications of modern science and set scientists to work in cooperation on a scope that has been surpassed on no single undertaking other than the project for the development of atomic energy.

Approximately described, the Continental Shelf is all of the ocean floor around the United States and its Territories that is covered by no more than 600 feet of water. The whole area is almost as large as the area embraced in the Louisiana Purchase, which was 827,000 square miles, and almost twice as large as the original 13 colonies, which was 400,000 square miles. Along the Alaska coastline the shelf extends several hundred miles under the Bering Sea. On the

Eastern coast of the United States the width of the shelf varies from 20 miles to 250 miles, and along the Pacific coast it is from 1 to 50 miles wide.

Two Presidential proclamations assert our sovereignty over the mineral resources of this ground, and our jurisdiction over the fishery resources of the high seas contiguous to our lands. The food and mineral resources of these areas are worth billions of dollars. Experts in the geology of oil lands would not be surprised if we found 22 billion barrels of oil—more than we are sure that we have on the continent—beneath one small part of the shelf that reaches into the Gulf of Mexico. Geologists also think that the shelf will yield rutile, sulphur, ilemenite, chromite, monazite and other heavy minerals. Their expectations are based on geologists' observations and on geologic reasoning. They have "tracked" lines of oil-bearing formations in the earth up to the shoreline, and they have good reasons to believe that the lines continue along the bed of the ocean. They also know which geologic processes create oil, and the shelf has undergone those processes.

The great wealth in this new acquisition is not something that we may take in a few decades or a few centuries We can begin taking it within a relatively short tme It is true that oil has never been recovered from fields that are distant from the shore and under 600 feet of water, but it has been recovered from a field that is a mile off the Louisiana shore and from another that is 2 miles off the coast of Texas. Techniques for recovering it from deeper waters appear to be possible to our scientists and engineers, and they must appear possible also to at least one oil company, for it has explored the waters of the Gulf of Mexico for oil up to 26 miles off the Louisiana coast.

This Department has been assigned to explore the shelf, and we have developed our plans so far as we can develop them without knowing how much money the Congress will appropriate for the work. We have acquired some of the extraordinary instruments that will be used; we are building or redesigning others. We are formulating a program for cooperative work by geophysicists, geologists, and engineers. Their work will be carried on partly aboard vessels and partly in submarines, and diving bells, and in airplanes. The cost of the survey may run to several millions of dollars if we include the cost of ships and equipment that have served their war purpose for the Navy and which are still in the Navy's possession. Even if we did count the cost of these essentials in the cost of the survey, which would be doubtful bookkeeping, the shelf would still be cheap. Alaska cost us $7,200,000; the Danish West Indies, $25,000,000; and the Louisiana Purchase amounted to $27,000,000. The Continental Shelf cost only the forethought that was required to assert our sovereignty over it.

Regional development is not a new theory of conservation, but rather an improved technique for developing, using and conserving our resources by the usual means—but doing it better, cheaper, faster, and to better purpose. It is the kind of logical next step in conservation that mass production was in production. We would continue to build dams, power plants, reservoirs, irrigation facilities, and other adjuncts of conservation. We would improve navigation, advance the propagation of fish and wildlife, and create and preserve recreational facilities. We would provide for flood control and for the allevation of stream pollution, but we would not plan any facility or program singly, nor would we be content to derive from it only those benefits which a single facility or program alone would provide. Instead, we would draw into one plan all of the dams and other facilities that a large region would need to develop and conserve its resources, build each unit, not as a thing in itself, but as a part of the whole, and we would design these unified projects to be operated as a single conservation-and-development program for the benefit of an entire region.

The great facilities which we have recently begun to build, especially those in the Missouri Valley, were designed as parts of a program of that kind. But these facilities and others that will be built later will not work as one unit of their own accord, regardless of how well-designed they may be. They must be operated as a unit, and this Department has helped to prepare for that kind of operation. The Senate Committee on Irrigation and Reclamation was given all of the guidance and information which this Department's extensive experience in conservation enabled us to give, when that committee held hearings on the Murray bill (S. 555). We are prepared to appear before any other congressional committee that may need us.

I approved of the principal aim of the Murray bill, which is to provide by statute that all of the conservation facilities in the Missouri Valley shall be used in coordination. However, I believed that the law should be amended to make possible similar benefits to the inhabitants of other river basins if they wanted them, so I recommended certain revisions in the bill which would assure the continued usefulness of those Federal organizations, within this Department and others, that now successfully administer the established conservation policies of the Nation. My recommendations have been published as a Senate document, and they have been particularized in a bill which this Department has prepared and proposed as a substitute for Senate bill 555, so I will not repeat them here.

There has been so much honest misunderstanding and deliberate misrepresentation with respect to my attitude on the development of our great river valleys that it may be worthwhile to make a brief statement here. I am not only in favor of the full and diversified development of our river valleys, I was one of the first men in public life to propose and advocate such a development. There are few if any differences between my views on the Murray Bill and those of the author.

My principal objection went to the question of administration. Whether the administration should be in the hands of a single administrator or of a board is not so much a matter of principle as it is of practicality. I cannot concur in the disposition that some people have to set up so-called independent boards that can go their own way in criss-cross fashion without any effective control by a principal executive who has the power to see to it that there shall be no waste or overlapping or unnecessary expenditure of money. It is airily suggested that the President, the most overburdened executive in the world, can undertake this additional little chore.

I do not believe that such a burden should be laid upon him. In the end there will be a number of these separate administrations, some of which will overlap as to functions and as to areas to be administered. Unless we are careful these could result in bad administration and worse feeling. As our Government is constituted today, it seems to me that these administrations should clear to the President through the Secretary of the Interior. This Department has had more experience than any other in this type of administration. To clear through the Secretary of the Interior, I do not suggest any lack of proper local autonomy. The history of this Department, especially during the past 12 years, has amply demonstrated our belief in local autonomy to the fullest possible extent consistent with proper coordination and sound administration. Unsupervised and too diffuse local autonomy might mean a series of political grab-bags that would discredit the whole theory of river valley authorities. I do not happen to believe in administration by a debating society and I doubt the efficacy of a shibboleth when it is expected to roll up its sleeves and go to work, day after day, to do a varied and intricate job for the people.

The Congress eventually will decide how these coordinated facilities shall be administered. Meanwhile we are so planning that they can be operated as single developments when a suitable policy has been formulated. Several bureaus and offices are cooperating in these plans so that the preservation of fish and wildlife, the creation of recreational facilities, and the other aims of thoroughgoing conservation will not be overlooked, but the Bureau of Reclamation is planning and building the principal facilities, and is coordinating the program.

The Bureau of Reclamation

This Bureau has presented to the Congress a postwar development inventory of 415 irrigation and multiple-purpose projects in the 17 States that are west of the one-hundredth meridian or are bisected by it. More than 100 of them are in operation, or have been authorized, or are under construction, and preliminary studies of others have been completed. Among the projects that have been authorized are 29 of those in the Bureau's program for basin-wide development of the Missouri River Valley.

These projects, calling for the construction of dams, irrigation systems, power plants and reservoirs for flood control and other purposes, would create employment for thousands of returning veterans and others, would open new lands to settlement, encourage the development of new business and industry, provide protection against drought and flood, increase Western purchasing power, and would, in many other ways, contribute to the National welfare.

Here, briefly summarized, is what the developments that are proposed by the Bureau of Reclamation would do:

1. Provide almost 200,000 new irrigated farms for settlement by veterans and others. (Construction of proposed projects would bring nearly 11 million acres of new land under irrigation and provide supplemental water to another 11 million acres which now have inadequate water.)

2. Provide jobs at the peak of employment for more than 400,000 workers at construction sites and for thousands of others working in factories, mills, mines, and in transportation throughout the country to supply the necessary materials and equipment.

3. Provide huge blocks of low-cost power for the development of natural resources, of new industry, and of business.

4. Create opportunities for farm workers, tradesmen and professional people in the new and expanded rural and urban communities that would result from such developments.

5. Greatly increase the purchasing power of the West for the products of other sections of the country.

6. Diversify and bring into greater balance the economy of these Western States in caring for an increased population.

Many other benefits would accrue from this program, not only to the persons who would be directly affected by the developments that it provides for, but to the whole Nation as well.

The first of the coordinated programs for regional development—that for the Missouri Basin—was approved by the Congress during the present fiscal year, and the Bureau is now completing studies and reports on 14 other major river basins in the 17 Western States. These studies also embrace tributary basins and many scores of individual projects.

It is from these studies and from 43 years of experience in developing the land and water resources of the West that the postwar program of the Bureau has emerged. The construction of the projects in the inventory will be dependent upon the action of the Congress in appropriating the necessary funds. Based on 1940 price levels, the estimated cost of constructing all of these projects would be approximately 5 billion dollars, but the major portion of such costs would be returned to the Federal Treasury from payments for irrigation water, proceeds from the sale of power generated at the projects, and otherwise. There would be, in addition, many indirect benefits that could not be evaluated in dollars and cents. The benefits to be derived would return many times over the cost of such a development program.

An understanding of the impact that such a program would have upon the Nation's peacetime economy can be gained from a review of what the projects that are in operation did during the war to help the United States to establish an unparalleled record of production.

Farmers on more than four million acres of land that is irrigated by Bureau facilities produced food, forage and fibre crops valued at more than $411,000,000 in 1944, setting an all-time record. As the result of the urgency of its war-food program, the Bureau, since 1941, has increased the irrigated acreage served by its projects by 759,000 acres. Of this total increase, 125,000 acres were brought under irrigation during the past fiscal year.

The Bureau's production of electric power has been equally spectacular. At the outbreak of the war we faced a critical shortage of power with which to meet the huge demands of rapidly increasing war production. We actually had a third less power available than the Axis countries had, and that deficiency threatened to retard seriously the production of munitions and equipment that were desperately needed by our armed forces.

How the Nation overcame that power deficiency is one of the stirring chapters in the history of the war. Our production of electric energy was stepped up to unprecedented levels, and the major contributors to that greatly increased output were the hydroelectric plants of the Bureau of Reclamation in the West—the plants at Grand Coulee, Boulder Dam, and elsewhere.

In 1941, Bureau plants had an installed capacity of 828,000 kilowatts. By June 1945, that capacity had been increased to 2,439,300 kilowatts. In speaking of the Bureau of Reclamation it should be borne in mind that the Tennessee Valley Authority, which is a separate agency, is not included. The power output of Bureau plants has quadrupled since the attack on Pearl Harbor. That output this year totaled nearly 14 billion kilowatt-hours, making the Bureau the largest single power-producing agency in the world. The bulk of its output went to war plants—aircraft factories, shipyards, chemical and metallurgical plants, ordnance works, steel, aluminum and magnesium plants, and also to cities, Army airfields and other military installations. It was also used to pump water for irrigation, and to electrify rural homes. From the Grand Coulee-Bonneville system alone came the power for processing one-third of the Nation's aluminum output for airplane production. Grand Coulee Dam also furnished the huge blocks of power needed for the construction and operation of the Federal government's "mystery war plant" near Hanford, Wash., one of the producers of the atomic bomb.

In these ways the projects of the Bureau of Reclamation contributed to the winning of the war. Now we must help to adjust the Nation to the conditions of peace. Our service men and women are coming back to seek jobs, to look for places to start farming, to practice trades, to establish themselves in business. We must help to keep our great industrial plant at full production, and to maintain the national income at a high level. To accomplish that, and to provide increased opportunities for our people we must apply the lessons learned during the war and bring to full development the natural resources which the Nation still possesses.

The program proposed by the Bureau of Reclamation for developing on a basin-wide scale the great river valleys of the West has that as its objective. Its operating projects have already pointed the way in showing what can be done through coordinated effort and intelligent planning. Similar projects will provide a solid economic foundation on which to build a stronger America, and afford the opportunities for richer, happier living for thousands of people in the years to come.

We cannot end a discussion of the world's largest producer of hydroelectric power without noting that in the harnessing of atomic energy we have a new challenger of the place of electricity. But when we have acknowledged its arrival, that is about all that we can do. We know that atomic energy has been used for the benefit of mankind, although not on a commercial scale. We do not know whether it could be used economically in industry. We presume that it will be used in industry, but we do not know even approximately how long it would take to develop it for such use. In a word, we do not know enough about it to justify an exhaustive discussion of the effect which atomic energy may have upon hydroelectricity.

The Division of Power

With the postwar period on the horizon the activities and responsibilities of the Division of Power have increased commensurate with the many complex problems inherent in the operations and the marketing of power from the largest aggregate of hydroelectric capacity in the world. As of June 30, 1945, the total installed capacity of the plants involved, was 3,107,300 kilowatts with a total generation during this fiscal year of 18 billion kilowatt-hours, more than five times the 3,672,995,000 kilowatt-hours produced by all of the power plants under the jurisdiction of the

Department in 1940. Again these figures do not include the production of TVA, a separate authority.

The Flood Control and the River and Harbor Acts placed additional responsibilities upon the Division. They directed the Secretary of the Interior to dispose of the power that is generated at the dams constructed by the Corps of Engineers. The ultimate installed capacity of these authorized projects will be more than 7,200,000 kilowatts.

In preparing for the transition to a peacetime economy, while meeting the needs of war, studies have been undertaken in order that the power that is under the jurisdiction of this Department may be disposed of in accordance with the policy that the Congress has forged during the past four decades—that is, in such a manner as to encourage the most widespread use at the lowest possible rates to consumers, consistent with sound business principles, and with a preference to public bodies and cooperatives. Consideration is also being given to the problem of the integration, with our Federal power projects, of fuel-operated generating plants that were built to serve some of our large military establishments and war plants.

The Division has reviewed or has participated in the determination of the allocation of costs of dams such as Grand Coulee, in the establishment of rate schedules, and in the negotiation of various contracts for the sale of power by the Bonneville Power Administration, the Bureau of Reclamation, and the Southwestern Power Administration. It assisted the Solicitor's Office in the negotiations for the disposal of the Hetch Hetchy power by the city of San Francisco in accordance with the terms of the Raker Act. It cooperated in the studies and negotiations of the Bureau of Reclamation for the proposed acquisition of the power facilities of the Salt River Water Users' Association in Arizona and of the Minidoka and Burley power facilities in Idaho in an effort to bring about unified operating systems and to make possible lower rates. It also assisted the Puerto Rico Water Resources Authority and the territorial government of the Virgin Islands in connection with their power problem.

The Bonneville Power Administration

America's best insurance against the threat of possible economic chaos is its supply of human and natural resources, and the ability to convert both into national wealth under a system of free enterprise. The Pacific Northwest, with its inexhaustible supply of hydroelectric power and its still untapped reserves of some natural resources, will be expected to contribute much toward a balanced economy. In view of this, and recognizing also that difficulties would be caused by cutbacks in war industries, by reconversion, and by the dislocation of industries after the war, the Bonneville Power Administration, early in the fiscal year 1945, set out to make a realistic appraisal of the job ahead.

A brief analysis of the Administration's war loads indicates that possibly as much as 600,000 kilowatts, or approximately half of the Administration's total production, may become available for remarketing. In order that this power may be marketed as quickly as possible and to prevent, insofar as is possible, any loss of the Pacific Northwest's wartime industrial gains, the Administration is devoting considerable effort to an extensive program of market and system development. The marketing program is directed toward the development of new power outlets for industries that will directly or indirectly provide jobs for returning service men and displaced war workers.

Cooperative research programs have been established with major educational institutions in Oregon, Washington, Montana, and Idaho to study and develop the potentialities of farm electrification, of electric home heating, or electric generation of processed steam and of other projects that, if developed, would require electricity.

Bonneville's own research staff is gathering data on railroad electrification, on the application of power in the development of the plastic industry in the region, on electric space heating, on urban and rural power utilization and on other potential uses for Columbia River power.

A program of system development, which was formulated by the Branch of Engineering and Operations, contemplates the early investment of approximately $164,000,000 in new transmission facilities designed to bring low-cost power from existing and proposed Columbia Basin projects to farms, homes and industry throughout the region. The new facilities will enable the Bonneville Power Administration to bring power into power-deficient areas, and will make Columbia River power available to any point in the Northwest at the Bonneville standard wholesale rate of $17.50 per kilowatt-year.

This postwar construction program will provide approximately 46 million man-hours of work at the construction sites and a great number of jobs in the manufacture and transportation of the equipment and materials that would be required.

Initially, the function of the Bonneville Power Administration is regional development; its final objectives are social and economic progress. The mechanism by which these ends are to be achieved is the marketing of an inexhaustible natural resource—Columbia River hydroelectric power. Unlike many Federal development agencies whose programs, in varying degrees, have been arrested in the course of the war, the activities of the Bonneville Power Administration have shown marked acceleration, to a large extent due to war necessity.

During the fiscal year 1945, Congress passed the omnibus rivers and harbors bill which authorized the construction of four dams on the Snake River in Idaho and the McNary Dam on the Columbia near Umatilla, Oreg. The Flood Control Act was passed, authorizing appropriations for the development of the Willamette Basin project, including the Detroit, Lookout Point, and Quartz Creek Dams. In both bills Congress authorized the Secretary of the Interior to market surplus electric energy from the proposed projects.

With these projects authorized for early postwar construction, the Bonneville Power Administration began to develop an extensive program of construction and of market development to encourage the utilization of the Pacific Northwest's water resources for the benefit of the region.

Operations during the fiscal year have been eminently successful. In addition to having made a contribution of incalculable value toward winning the war through service to war industries, military establishments and agriculture, the Administration has progressed in its construction and power marketing programs. The financial position of the project is sound and may be expected to remain so despite temporary setbacks that were caused by the changeover from full wartime to partial peacetime activities.

The transmission system that is serving all of the major load centers, particularly those which have been engaged in war goods manufacture, and also much of the outlying region, will be ready for further expansion according to already completed plans as rapidly as manpower and materials become available.

The Southwestern Power Administration

During the past fiscal year the Southwestern Power Administration continued to operate the Grand River Dam project, marketing the power that was generated there, and at the Norfolk and Denison Dam projects, which are operated by the War Department.

The Grand River Dam project, which is owned by the Grand River Dam authority, an agency of the State of Oklahoma, was under Federal control for the duration of the war. The Government completed the transmission system and made contracts to dispose of the power output to war industries, chief among which are Camp Gruber, an Army camp near Muskogee, Okla.; Oklahoma Ordnance Works, near Prior, Okla.; The Cardox Corporation at Claremore, Okla., and the Jones Mills Aluminum Reduction Plant at Lake Catherine, Ark. During the past 2 years, the Southwestern Power Administration has worked to secure desirable industrial loads for the project, which would continue after the war. As a result of this work, service was begun to The B. F. Goodrich Co. plant at Miami, Okla., in December 1944, under a permanent contract.

The Norfolk and Denison Dam projects are each equipped with one 35,000-kilowatt generating unit. They have no transmission systems. It was, therefore, impossible to sell the electric production of these two projects directly to wholesale users. Contracts were negotiated with the neighboring private companies, under which the companies purchased all of the power output for their own use. The private companies in return, have made substantial rate reductions to Government-owned facilities and to other consumers, by specific provision of the contracts. These two projects have been in full commercial operation since March 1945.

The Administrator of the Southwestern Power Administration has made and published a general study covering all of the constructed, authorized and proposed War Department dams in the Southwest. We intend to initiate the program of development during the next fiscal year.

Bureau of Mines

The continuation of the many varied scientific and technologic activities of the Bureau of Mines provided assistance to the producers and manufacturers of war materials and to the armed forces, and also resulted in the addition of a wealth of technical information which is expected to benefit the Nation in the readjustments of the post-war years. These services to industry and to the Nation obviously are worth many times what it cost the Bureau to render them.

Many of the advances made in the laboratories and pilot plants that are operated by the Bureau were achieved under the pressure of a national emergency, but they will help the mineral industries to adjust themselves to a new peacetime economy. This is especially true in the field of mineral exploration and development; that is, in the search for critical and essential ores and in experiments to find the best and quickest methods of converting these ores into usable metals and other mineral commodities. During the war years, the Bureau performed a great deal of this kind of work, because of the need for speedy action to meet changing requirements.

Equally important technological results were obtained in many other widely diversified fields in these years, including research in coal and coal products, explosives, ventilation, petroleum, synthetic fuels from coal and oil shale, air and dust analyses, and fuel efficiency. The Bureau's specialists strove to answer questions that would solve urgent wartime problems, and they answered many of them.

Not all of the Bureau's experiments were successful, but that is not expected in any kind of scientific research, and enough of them yielded results to cause other war agencies to depend more and more on the Bureau in certain fields. Many of the techniques and processes that were developed by the Bureau during the war already have been adapted by private industry and in Government-operated plants, and others are being considered in long-range post-war planning.

The Bureau's staff also provided valuable aid in consultation with Government and industry in fuel efficiency, in the conservation of manpower through safety training and accident prevention, and in promoting a more efficient utilization of all resources. Furthermore, the factual information that was supplied by the Bureau about the production, distribution, and consumption of scores of mineral commodities was important to the war planning of many agencies and is essential in peacetime to industry. Most of the technical information accumulated by the Bureau in 1939–45 has been compiled and published.

Without waiting until the end of the war, the Bureau of Mines began to plan for the postwar era, with the hope that the Bureau and the Department might be helpful in formulating a future mineral policy for the Nation. I have already discussed our depleted mineral resources, and I have recommended some remedial measures. I here recommend further that we do all that can be done to insure the health and safety of workers in mines and smelters and plants, both to conserve manpower and to make additional reserves available by the removing of hazards. The Bureau of Mines has had more than three decades of experience in this field, and gave the advantage of this to Government and industry during the war. Accident rates declined and the production of coal mounted despite manpower shortages, loss of skilled workers to the armed forces, and the inability to replace worn machinery. Innumerable safety improvements were made as the result of the Bureau's inspection of 3,400 coal mines last year. Thousands were trained in first aid, mine rescue, and accident prevention, and Bureau engineers saved lives by assisting at major mine fires and explosions.

Without a detailed knowledge of the economic conditions in the minerals industries, no program of exploration and investigations could be expected to succeed. I think that the Bureau of Mines should be authorized to expand its economic and statistical services to obtain accurate and up-to-date information on the production, distribution, and consumption of all of our minerals and fuels.

The mineral legislation under which the Bureau of Mines operates now, with one or two exceptions, is permissive in nature. The Bureau in general is an advisory agency, and is in no position to exercise any authority over the use of mineral resources. New legislation designed to cope with postwar problems should be more positive, requiring specific things to be done, and having the effect of defining a national mineral policy. A good example of the type of legislation needed is the Synthetic Liquid Fuels Act, which sets forth a specific 5-year program of research in the production of gasoline and oil from coal and oil hales, defines clearly what should be accomplished, and appropriates funds for the purpose. Another is the Federal Coal Mine Inpection Act, authorizing the inspection of coal mines in the interest of safety and efficiency.

With its pilot plants and laboratories, its engineers, chemists, metalurgists, geophysicists, and other trained personnel, the Bureau of Mines is ready to put into effect a Nation-wide program of mineral conservation and development which it believes will be in the interest of future security and national welfare. Many of its recommendations have been submitted to Congress, others are in advanced stages of development.

The Geological Survey

Geology is becoming increasingly important to the Nation's social and economic welfare. During the war our geologists located new mineral deposits by applying geologic principles. They also predicted for the military intelligence the terrain conditions in those areas in which combat operations had to be conducted. While their military activity was perhaps the more spectacular and won numerous military commendations for directly assisting the armed forces, the Survey's information about our mineral deposits, and its program of searching for new ones, contributed materially to solving the country's supply problem.

Turning from the past to the future, the Survey recommends a considerably extended program of aerial geological mapping so as to provide the necessary geological basis for sound planning in the development of our resources. The Survey also recommends continuation and extension of the scientific investigations that, during the war, were conducted cooperatively with geologists representing our allies. These international projects not only bring mutual scientific benefits but they can become a strong contributing force towards better international understanding.

During the year the Alaskan Branch continued its investigations of mineral deposits in Alaska, performed geologic services for the War and Navy Departments, and compiled aeronautical pilotage maps and charts for the Army Air Forces. The investigation of mineral deposits contributed to a more adequate inventory of Alaska's mineral resources, particularly in regard to deposits of mineral materials other than the precious metals. The Branch's geologic service to the armed forces was principally in regard to phenomena associated with permanently frozen ground. An understanding of these phenomena is necessary for carrying on construction activities in frozen-ground areas. The compiling of aeronautical pilotage maps was a continuation of the high-priority mapping from aerial photographs that has been carried on for several years by the Alaskan Branch for the Army Air Forces.

The limitations of funds and personnel prevented the undertaking of any activities aimed toward satisfying the many anticipated needs for information regarding Alaska. Plans for fulfilling Geological Survey responsibilities in Alaska have been made, however, and will be put into effect so far as funds and personnel permit as postwar needs become more acute.

In the Annual Report of the Secretary of the Interior for the fiscal year ending June 30, 1938, the percentage of the area of the United States covered by topographic maps was given as 45 after deductions had been made for maps that had become obsolete and inadequate. As the latest report gives the percentage as 47.7, the average annual increment over the 7-year period is approximately 0.4 percent and for the 65-year period of the Survey's activity the average annual increment is 0.74 percent. At these rates from 70 to 130 years may be required to map this country completely. At this critical period in our history when a serious, thoughtful effort should be made to appraise our national economy and plan for the future, the lack of this essential part of the basic knowledge required for intelligent planning is a serious handicap that we should strive to overcome.

The investigations of the quantity and chemical quality of the Nation's water resources have been continued. These investigations, which relate to a varying and recurring resource, yield records that are widely used by administrative officials in planning water projects, in dividing water among users, and in determining and administering water rights. The records are also used by engineers in the design and operation of hydraulic works and other structures affected by water; by financiers in the consideration of investments; and by lawyers and courts in the adjudication of rights and the assessment of benefits and damages. During the war the information has been conspicuously valuable in the placement, design, and operation of military and naval establishments of many kinds, including power and industrial plants, munitions plants, cantonments, airfields, and hospitals, and in developing water supplies for new concentrations of population brought about by war activities. It will be no less useful in the postwar period of adjustment and reconversion to the requirements of the Nation at peace. As the limits of supply are approached, more and better water is always being sought, and investigations of its availability and utility must be continued.

Although hampered by manpower deficiencies in critical positions, in both field and headquarters staffs, the Conservation Branch has maintained a high level of accomplishment in classifying the public-domain lands as to their mineral and water-power potentialities, in supervising the development and production of minerals from leased lands under Departmental supervision, and in rendering consultative assistance to various Government agencies and to individuals concerned with public-land administration and minerals development.

The land-classification activities required the expeditious handling of more than 13,000 cases, each involving many geologic investigations and determinations by the field and headquarters staffs; the administrative definition of the known geologic structure of seven producing oil or gas fields; the geologic appraisal of 80 unit plans of operation; and numerous special reports to the General Land Office, mostly in aid of a program for the discovery of new oil and gas fields or deposits during the national emergency.

Mineral-lease supervision, involving the work of special study groups, and the regulation of the development and production of coal, oil, gas, sodium, potash, lead, zinc, and many other minerals from public, Indian, and Naval-petroleum-reserve lands, were continued with due regard to those approved conservation principles which have long guided the Survey in its minerals-recovery policy. Known reserves of such minerals on leased lands under supervision are estimated to have a value in place in excess of 2 billion dollars. Production from these reserves amounts to $150,000,000 annually and is rendering royalty returns in benefit of the public interest amounting to $12,000,000.

The Solid Fuels Administration for War

Despite numerous difficult wartime obstacles, the coal mining industry has supplied the unprecedented quantities of fuel required by war production plants to equip the armed forces. This the coal-industry accomplished with the smallest labor supply in a half century.

The civilian population, although at times inconvenienced by winter emergencies and frequently having been obliged to burn substitutes, has had sufficient solid fuels to keep healthfully warm, if not always comfortable. The Nation also has had enough fuel to maintain its wartime civilian economy at an extraordinarily high level.

This is an achievement of which the industry, the government and the consumer can be proud, considering the difficulties involved. We solved, by democratic processes, the perplexing problems which our enemies would have sought to solve by despotic procedures. It was the result of careful planning and control by the Solid Fuels Administration for War, of hard work and good management by the miners and operators, and of cooperation by all parties concerned.

During the war the American miners' average output rose to the highest level of all time; higher than that of any other nation. They worked longer hours than the free miners of any industrialized country in the world.

Difficulties encountered in the production of solid fuels lay, primarily, in the steady loss of mine manpower to the armed services and to other wartime industries. In many instances mine workers were attracted by higher pay and safer, less arduous employment. We cannot, however, overlook the fact that recurrent disputes between labor and management, which plague this industry in peace and war, prevented the production of additional coal. We were able to hasten the restoration of mine output, thus avoiding major impairment of war production, by helping to speed the settlement of disputes and by taking possession of the mines on various occasions.

While we did not lack fuel from underground which was needed to wage this war, the heavy wartime drain accelerated the depletion of reserves of high grade metallurgical coals and other special purpose coals, and brought closer the time when it will be necessary to deal with the problem of their exhaustion.

The most critical period with respect to our supply of solid fuels occurred in the fiscal year just passed. Bituminous-coal requirements soared to an unprecedented 626,000,000 tons during the fuel year which ended on March 31, 1945. Yet the lack of mine manpower and all-too-frequent strikes caused production to fall some 16,000,000 tons under that figure. Furthermore, we were approximately 5,000,000 tons short of the 66,100,000 tons of anthracite necessary to meet our needs.

Since these deficits in bituminous coal were of particular kinds that were essential to the manufacture of steel, chemicals, and other vital war goods, and upon which a large part of the Nation depended for heating fuel, they presented problems of unusual complexity. It was only by exercising the most careful control of distribution of mine output, by requiring industries to use coal out of stockpiles built up to record heights earlier in the war, and by the insistence upon fuel conservation and the acceptance of alternative fuels by industries and householders, that those problems were solved.

The high degree of success with which distribution difficulties were overcome was due, in great part, to the cooperation of producers, wholesalers, dock operators, and retail dealers in carrying out, without recourse to coupon rationing with all of its undesirable aspects, measures for maintaining an equitable sharing of the available solid fuels supply.

Early in the war, the need for careful planning and control of distribution was recognized. Requirements were forecast a year ahead, production was estimated in advance, and basic distribution patterns were established. Industry representatives were consulted extensively in the formulation of programs. Normal distribution channels were disturbed as little as possible. Controls and regulations were kept at a minimum, giving industry the widest possible latitude for exercising judgment. Under such a policy, producers and conumers alike were enabled to act intelligently. Probable difficulties vere detected in sufficient time to permit appropriate counter neasures to be taken as they arose.

We did everything within our power to help the coal-producing ndustry to increase its output. This included aid in obtaining the leferment of as many essential workers as possible from military nduction and in providing mine operators with machinery, equipnent and supplies. We made a vigorous, if unsuccessful, effort to btain the release of experienced mine workers from military service fter the fighting in Europe was ended. I regret that, because of the lack of funds, we were unable to carry on as effective a fuel-conservation program as conditions seemed to require.

It now appears that the job of maintaining an adequate fuel supply during the winter of 1945–46 would require that the Solid Fuels Administration for War retain the right to direct the distribution of solid fuels, and to stimulate the use of alternative fuels wherever the scarce types are not available.

Disruptions in the flow of coal, due to bad weather, strikes, or other causes, may require emergency action from time to time. We face a most difficult task in preparing for such emergencies while at the same time shipping coal to Europe to help prevent chaos and anarchy from sweeping the liberated nations because of the lack of fuel.

The General Land Office

The public land is an asset which must be taken into account in any evaluation of the natural resources of the United States. This 778-million acre domain belonging to the people is conservatively estimated as representing nearly a quarter-billion dollars' worth of real estate which is under the administration of the General Land Office. While it is obvious that no man can compute with unalterable accuracy the permanent value of land, it is believed that this vast expanse of public domain in the United States and Alaska comprises real estate values aggregating $235,000,000 of which $125,000,000 are located in the United States itself. Roughly divided, the assets comprise forest lands and woodlands worth $160,000,000, grazing lands (outside of districts administered under the Taylor Grazing Act) whose value is placed at $30,000,000, and other lands, including barren areas as well as those devoted to special uses, valued at $45,000,000. In addition to this conservative evaluation of the land, technical services rendered to the public and to agencies of both Federal and state governments by the General Land Office constitute other less tangible factors whose values are estimated to bring the total worth of the people's assets in this real estate to $250,000,000.

The continued management of this property under progressive conservation policies for use and development with an eye to th requirements of the future, is essential, since in no other way ca the domestic demands for maximum beneficial use of the land and it resources adequately be met in the reconversion period.

Already, the trend of scientific research has pointed the way t new fields of usefulness for the public domain, broadening the scop of activities in the development of resources beneath the surface an increasing the opportunities for utilization of the land itself. Th wider horizons for mineral uses revealed by the discovery and development of atomic energy, the steadily mounting requirements for lumber and other forest products to repair the ravages of war, and the growing demands for ex-servicemen for land settlement opportunities, serve to illustrate the trend toward more extensive usage in the year immediately ahead.

Obviously, this contribution to future economic advancement will enhance the value to the American people of their public domain. However, it will also bring a corresponding increase in the responsibilities facing the General Land Office. New methods and new laws must be provided with which to carry out these new tasks which, in effect, mark the beginning of a new era in national land administration.

Land administration experiences in connection with the prosecution of the war have sharply accentuated the pattern for efficient management of the public domain in time of peace. At the close of the 1945 fiscal year, definite alterations in Federal law and in procedures of the General Land Office were revealed as imperatively needed to bring about the type of management to which the public is entitled and without which the maximum beneficial use of the national lands and their resources, cannot be assured. Some of these needs long have been recognized, but their enactment was held in abeyance for the duration of the war. Today, freed from the restrictions of military necessity, problems awaiting solution include the rejuvenation of our Federal mining laws and the enactment of a general mineral leasing statute. A thoroughgoing examination of the remaining vacant public land to determine its availability for homesteading use also should be undertaken to meet to some extent the needs of returned veterans for land settlement opportunities in the United States and Alaska. Other factors equally essential to the successful administration of a well-rounded and integrated national land use program are set forth in the detailed report of the General Land Office.

Meantime, it is noteworthy that this official real estate agent of Federal Government closed its books for the 1945 fiscal year with a net profit both in conservation advancement and in financial gains resulting from its work. Operating through four branches with 12 divisions in Washington, 5 agencies in the field with 25 offices scattered throughout the West and in Alaska, and 25 district land offices also strategically located for service in the West and in the Territory, the activities of the General Land Office produce cash returns several times greater than the expenditure incident to its maintenance. In 1945, these cash receipts totalled $13,381,654 and represented a ratio of $5.66 for every $1 of the expenditures, which aggregated $2,365,005. This was the second consecutive year in which the receipts exceeded $13,000,000, and the fourth time that receipts of the General Land Office have exceeded $10,000,000 since 1880.

Aside from these financial accomplishments, definite progress was made during the year in the conservation of natural resources on the public lands. Foremost among its obligations in this field is the establishment of sustained-yield forest management on all of the Federal lands under its jurisdiction, as required by congressional mandate enacted during the 1945 fiscal year. Under this program, forestry operations on the timbered public domain eventually will be brought into a balanced ratio in which the volume of tree-cutting and tree-growing will be regulated so as to provide a continuing supply of timber.

Definite contributions to the Nation's lumber needs were made during the year from the 2½ million acres of revested Oregon and California railroad grant lands in western Oregon under the administration of the General Land Office, operating through its Oregon and California Revested Lands Administration in Portland, Oreg. In 1945, sales of timber from these lands exceeded 426,000,000 board feet valued at approximately $1,518,000. Meanwhile, definite plans for cooperation with private management in the maintenance of sustained-yield forest practices on intermingled public and privately owned lands were advanced during the year.

Prospects of postwar development of Alaska which will increase the burdens of the Alaskan Fire Control Service in the prevention and suppression of fires on more than 250,000,000 acres of public domain in the Territory, confronted this branch of the General Land Office at the end of the 1945 fiscal year. The end of the war is expected to bring about an unprecedented number of tourists and settlers, the reopening of mining operations, and the construction of new airfields and roads, all of which will present new and greater fire hazards.

Favorable weather conditions in 1945 resulted in the smallest fire loss in the 6-year history of the organization. During the year the service took action on 57 fires with a total burned area of 2,535 acres, of which 624 acres were on private land. There were 13 fires inaccessible to the Service which burned over an estimated 110,200 acres. The number of fires for the year, therefore, totaled 70 with an aggregate loss of 112,735 acres. Service records show that more fires were caused by lightning in 1945 than in former years, about 37 percent of the total number of fires being started by lightning, and approximately 98 percent of the total acreage consumed being due to lightning fires.

In the 1945 fiscal year, the use of more than 12,400,000 acres of public land in the United States and Alaska for the grazing of livestock was supervised by the General Land Office as part of its administration of the people's real-estate assets. Consisting of tracts in Alaska that are suitable for grazing purposes and of similar areas in the United States that are not included in the established Federal grazing districts, a total of 12,479,270 acres was made subject to use under 10,593 leases involving annual rental of $229,523.

The Office of Land Utilization

Experience in the Department of the Interior during the past several years has clearly demonstrated the value of effective coordination and close cooperation in the field of land and resource management. The Office of Land Utilization, which is charged with the reponsibility of coordinating and integrating the land-use and land-management activities of the several bureaus and agencies of the Department, continued its policy of promoting unified action through cooperative efforts, the dissemination of information, and the rendering of efficient advisory service.

The methods pursued have proved to be successful and have operated definitely in the public interest. It seems clear that the time has arrived when the principles of coordination and cooperation should be extended to all agencies that operate in the conservation field. The effective use and development of the basic wealth of the Nation—its soils and waters, its forest and pasture lands—will not be at its best until all interests involved have fully coordinated their responsibilities and activities.

The Grazing Service

On the whole the surface resources of the Federal range in grazing districts are in as good condition as they were in at the beginning of the war, or in better condition. Even so, the range made an effective contribution to the Nation's needs for war. This is in sharp contrast to the situation of the First World War when increased numbers of livestock on the open public domain, then unregulated, stripped the forage and hastened its depletion without adding materially to food supplies during that conflict. The range livestock industry itself, aided by stabilized range use fostered by the Taylor Grazing Act, is now in a strong position to cope with the problems of postwar readjustment.

The use of 14½ million acres of Federal range as testing grounds for machines and training grounds for men emphasized the importance of these lands as a key to successful global warfare. While it was necessary to exclude livestock from certain military training areas and testing areas such as the one used in the atomic bomb experiment in New Mexico, it was possible through special arrangements with the military authorities to provide alternate grazing during the war period for nearly 500,000 sheep and 16,000 cattle on areas set aside for war purposes.

Livestock production levels of the earlier war period were maintained and in some localities exceeded during the year ending June 30, 1945, although slightly fewer animals were permitted on the range than in the previous year. Total numbers licensed to use the range declined 6 percent from 10,694,305 to 10,019,178, a reduction of 675,127 head. There were 725,464 fewer sheep but 86,174 more cattle. The number of authorized users decreased by 912 from 22,562 to 21,650. Big game increased from 535,000 head to 583,000.

On the basis of natural wealth and long-time economic values, the surface resources and facilities of the Federal Range, administered by the Grazing Service, have an assumed capital value of not less than one-half billion dollars. Although the principal use made of range land is the grazing of livestock and the providing of food and shelter for big game, these purposes are closely related to those of other resources among which are the soil, water, wood, and crop lands, and recreational areas. The administration of these land aims, in addition to stabilizing the dependent livestock industry, to accomplish the conservation and proper use of all of the resources upon them. Progress toward these objectives by the Grazing Service, although interrupted by high priority war needs, was in general satisfactory during the fiscal year just closed.

The Fish and Wildlife Service

If all of the economic and game animal resources were to vanish from this continent tomorrow, the United States could reckon this catastrophic loss at something over a hundred and forty billion dollars. This is the value which the Fish and Wildlife Service places on the birds, mammals, and fishes which inhabit the Nation. The abundance of these resources is in a state of continual change. Against the many forces acting to reduce it—such as excessive exploitation, pollution, diversion of water for industrial uses, etc., the Fish and Wildlife Service is acting in various ways to increase it. This service to the Nation is evaluated as being worth approximately 30 million dollars a year.

The war has had little, if any, effect upon the abundance of our continental fish and wildlife resources. If anything, it was beneficial to it, since hunting and fishing were generally below peacetime levels.

However, certain of the commercial fisheries increased the intensity of their operations in response to augmented demands for protein food, and imposed added strains on the stocks of those species which they exploit. Hence the problems of restoring stocks that have declined in quantity will be one of the most important post-war activities of the Fish and Wildlife Service.

From the standpoint of conserving fish and wildlife, a problem of primary importance has been created by the increasing uses of water for public purposes. However, the disposal of sewage and industrial waste products, is an obnoxious nuisance. As a result of the researches of Fish and Wildlife scientists, pollution is becoming less excusable each year. This is because the Service is constantly improving and enlarging the criteria of acceptable water quality, and is constantly striving to develop methods of utilizing waste. Largely as a result of these efforts, domestic sewage and almost every kind of industrial waste can now be disposed of by practical and commercially profitable means. Thus, conservationists have an unassailable position in answering any assertion that it is too costly or impractical to avoid defiling our streams. Indeed, many industrial enterprises in the fields of distillation, brewing, canning, petroleum refining and electroplating have not only been able to eliminate waste, but to do so at profits greater than those derived from some of their basic products. Thus it looks more hopeful than ever that pollution will gradually become a less menancing evil as our fight against it progresses.

Meanwhile the accelerating trend to modify water courses for power, irrigation, and flood-control projects, is a serious threat to the resident animal life. A dam can change a stream enough to exterminate the most valuable fish and wildlife resources dependent on it. Yet it is possible to devise means of modifying that dam so as to preserve those resources. That is what the Fish and Wildlife Service is endeavoring to do wherever major water utilization projects are under construction or are being planned. There are few if any precedents or principles to guide in this work. For the most part each dam presents an entirely new set of conservation problems which must be solved before construction, and tested afterwards with results that may not become evident for several years. During 1944, an experiment designed to preserve the salmon of the Columbia River, which were stopped in their upstream migration by the unsurmountable Grand Coulee Dam, was tried for the first time. This involved trapping the fish and hauling them overland by truck to the tributaries below the dam. The remarkably successful results give hope that the problems of preserving the animal stocks in the numerous other places where dams are projected, will be as successfully solved through the intensive study that the Fish and Wildlife Service is carrying on.

The encroachments of civilization upon primeval habitats has em-
asized the importance of refuge areas as the most effective device for
nserving wildlife. During 1944, six large areas were added to the
tional system, which now furnishes protection to about 25 percent
the waterfowl resources.

The Office of the Coordinator of Fisheries

The year 1945 brought the completion of the principal task which
d been assigned to the Office of the Coordinator of Fisheries upon
s creation early in the war. This was to restore and maintain the
ility of the fishing industry to produce the protein foods, vitamin
ls, animal feeds, and industrial oils which were needed in exceptional
antities for war purposes. The productive capacity of the industry
s been shattered by the events of the first months of war. The
quisitioning of boats, the drafting of skilled fisherman, the heavy
eds of the military services for netting, cordage, marine engines,
d most of the other essentials of fishery production, all made the
oblem of meeting the heavy war demand for fishery products an
pecially difficult one.

From its normal level of about 4.4 billion pounds, the yield of
uatic products declined in 1942 by half a billion pounds. Beginning
1943, however, production made steady and gratifying increases,
tually exceeding the peacetime yield in 1944 and continuing to
in in 1945.

This steadily increasing production was achieved principally by
storing the numerical strength and effective functioning of the fishing
eet. Specifically, it was brought about by the construction of new
shing craft, the provision of facilities for repair, and the supplying of
ets, cordage, and other equipment that was necessary to production.

During the period from May 13, 1943, to June 30, 1945 the Coordi-
ator's Office authorized the construction of 2,002 new fishing vessels
nd recommended the approval by the War Production Board of
pplications for controlled materials and products worth $9,053,605.
addition to acting as claimant for the fishing industry before other
overnment agencies, the Coordinator's Office administered produc-
on programs controlling fisheries which collectively yield about one-
ird of the total United States production—those for the Pacific
rdine or pilchard and for the salmon of Alaska and Puget Sound.
nder these programs, the available manpower and equipment were
sed far more effectively than would have been possible otherwise,
nd the yield of these important fisheries was maintained at a satis-
ctory level in relation to the stocks of fish.

In carrying out its wartime task of supplying the aquatic products
hat were needed for war, the Coordinator's Office has also worked

to safeguard the fishery resources from excessive drains which would impair their future value to the Nation. In contrast to the situation at the end of World War I, the fisheries as a whole have been maintained in sound condition.

The National Park Service

The National Park Service, although operating throughout the war with greatly reduced personnel in the field and at its headquarters experienced a steady increase in travel to the 169 areas that it administers. This increase became more rapid with the end of the war in Europe; next it became a flood. Not only did this suddenly increased use of the National Park System place a heavy strain on the organization of the National Park Service and of the companies operating concessions; it also forecast a volume of travel during the next season which may well surpass the record year of 1941.

This prospect points to the necessity of bringing the Service's organization back to approximately its prewar size and functions This will be impossible without funds to supplement those now available, since the present appropriation was determined in the expectation that the war with Japan would continue for another year at least, and that the wartime low volume of travel would continue

The National Park System has been weathering the war period without material damage to the resources of scenery and history and science which it is charged with conserving. Perhaps the most serious threats to such resources were found in the efforts to open parts of Olympic National Park to the logging of Sitka spruce and of Great Smoky Mountains National Park to the cutting of its virgin stand of red spruce. Proposed legislation, which would have compelled the opening of all national parks to the grazing of domestic livestock, aroused such widespread opposition that no action was taken on it in the Seventy-eighth Congress, neither was it introduced in the Seventy-ninth.

Although the work of the National Park Service was not considered to be tied in directly with the prosecution of the war, the areas that it administers provided much-sought recreational opportunities for members of the armed forces and those engaged in war industry, and it is also fair to say that the system through war permits made its appropriate contribution to the victory.

Immediately ahead of the National Park Service, as soon as funds can be made available for it, is a program of reconditioning of roads and trails and of the utilities and facilities that are used for administration and for direct service to the public. For this it is estimated that $1,200,000 will be required during the next year or two. Along with that should go an orderly program of needed developments.

All construction has been halted for 4 years. A program should be started for the acquisition of non-Federal lands within the boundaries of areas in the park system. These holdings, amounting to more than 600,000 acres, make it difficult to furnish adequate protection to Federal properties, add to the expense of providing needed developments, and are open to undesirable and destructive uses.

The controversy over the establishment of Jackson Hole National Monument was marked by two important events: The late President Roosevelt's veto of the Barrett bill, which would have abolished the monument, and District Judge Kennedy's decision, in the Case of the *State of Wyoming* v. *Paul Franke,* affirming the legality of the President's action in establishing the monument. Representative Barrett has reintroduced his bill and Senator Robertson has introduced a bill to amend the Antiquities Act of 1906 by providing that the establishment of a national monument would require approval by the Governors and a majority of the congressional delegations of the states affected. No action has yet been taken on either of these nor on any of the four other bills now pending which would amend or abolish the Antiquities Act. I continue to believe that it is still true that only vision and perspective can be relied upon to save for Americans of future generations outstanding areas that belong to the whole people.

The cooperative responsibilities of the National Park Service have been appreciably enlarged through the first appropriation to implement the Park, Parkway, and Recreational Area Study Act of 1936; by studies, underaken at the request of the Corps of Engineers, of the recreational values of reservoirs proposed to be built by them; and by a study, launched at the request of the Bureau of Reclamation, of the same sort with respect to their prospective reservoirs in the Missouri Basin. By agreement with the Bureau of Reclamation, the Service is also undertaking the administration of the recreational resources of the Friant and Shasta Dams in the Central Valley project in California.

The Office of Indian Affairs

The Office of Indian Affairs reports some important gains during the past fiscal year.

The program of land acquisition and consolidation has been continued; 257,000 acres, formerly opened for settlement but unclaimed, were restored to Indian use. Tribal funds, totaling $177,000, were used in purchasing 63,000 acres on 12 reservations, much of this land being from Indian estates complicated by heirship. The Jicarilla Apaches newly completed their program of consolidation, and the Southern Utes reacquired 40,000 acres at a cost of $83,000. The

Rosebud and Cheyenne River reservations have made notable progress in the exchange of heirship interests for use-rights in tribal lands, thus enabling many Indians to engage in, or enlarge, farming and livestock operations.

Recent experience has demonstrated the facility with which the resources on Indian lands could be developed for the national benefit. Thus far during the war, 11,400 oil wells on Indian lands produced more than 70,000,000 barrels of oil, principally in Oklahoma, Montana, and Wyoming. During the past fiscal year Indian wells yielded 23,000,000 barrels of oil. The excess draft on this nonrenewable resource, however, was not too heavy, and conservation practices continued to be applied in the Osage field. The yield of the Cutbank field on the Blackfeet Reservation began to decline in 1945.

War bonuses made possible the extraction of some low-grade lead and zinc ores from the Quapaw lands, which yielded 78,248 tons of zinc and lead concentrates during the past year. The total production during the war years was 415,000 tons valued at $38,000,000.

More than half a billion feet of timber were cut and removed from Indian forests, the major portion being for military use. Indian sawmill enterprises produced more than 30,000,000 feet of lumber, but the principle of sustained yield was maintained.

Maximum production was maintained on 44,000,000 acres of forest and open range land, and overstocking generally was not permitted, although overgrazing still presents a difficult problem on the Navajo, Hopi, and Papago reservations.

In the calendar year 1944, the Indians earned a total income of more than $15,000,000 from their beef and dairy herds—an increase of more than $1,000,000 over the previous year. In addition, the livestock and livestock products consumed at home had a market value of more than $7,000,000.

Although about 45,000 Indians left their homes during the year to work in various industries, while 25,000 others were serving in the armed forces, those who remained at home produced nearly 5,000,000 bushels of cereal crops valued at $5,000,000. Other field crops with a market value of $3,500,000 were produced, while tree fruits, nuts, and berries, sold and consumed, were worth $775,000. Garden produce, raised by 32,000 families, was valued at more than $1,000,000.

Indians not only increased food production at home, but further contributed to victory by working for the Red Cross and by assisting in the war-loan drives. Many communities, in which income are small in terms of cash, made large contributions to the Red Cross, and war-bond quotas were frequently over-subscribed.

Indians in the armed services won high praise for their conspicuous gallantry on all fronts. The Office of Indian Affairs has recorded two awards of the Congressional Medal of Honor, 51 of the Silver Star, 0 of the Air Medal, 34 of the Distinguished Flying Cross, and 50 f the Bronze Star.

In April 1945, more than 400 Aleuts who had been evacuated to the ainland at the time of the Japanese invasion of the Aleutians reurned to their island homes. The Army and the Navy, with the elp of Indian Service architects, will rebuild their villages; and ndian Service teachers and special assistants are helping the natives o reestablish themselves.

Because of the great exodus of Indians from the reservations, the ttendance at Indian schools has decreased considerably, and many hildren who left home with their parents have been deprived of chooling. Much of this loss of education may be irreparable, but new emphasis is now placed on the value of education by those who re returning from the armed services. During the year the Navajos emanded by resolution that the Government keep its pledge of 1868 o furnish a schoolroom for each 30 pupils. There are nearly 20,000 avajo children of school age, but the school facilities will accommoate no more than 40 percent of them.

Because of the shortage of personnel, the health service was comelled to limit its activities largely to curative and palliative measures. uring the past year, 750,000 out-patient treatments were given, and 0,000 patients were placed in hospitals with a total of 865,000 inatient days.

During the year a judgment was entered in the United States Court f Claims, allowing the California Indians to recover $5,024,842.34 in artial satisfaction of claims arising from the Senate's failure in 1852 o ratify 18 treaties made with these tribes.

The Menominee swamp land case was settled by the payment of 1,590,854.50 from funds of the Menominee Tribe to the State of isconsin for 33,870 acres of swamp lands within the boundaries of he Menominee Reservation.

Reexamination of claims for losses of personal property by the ioux Indians after the "Custer War" resulted in a departmental inding that the claimants were entitled to the additional sum of 101,630.

Although the Colorado River Reservation was set aside in 1865 or the Indians of the river and its tributaries, colonization of the rea was not feasible until, at the outbreak of the war, the completion f the Headgate Rock Dam and its distribution system made possible he irrigation of 100,000 acres of land. In May 1945, the War elocation Authority returned to the control of the Indian Service ,000 acres of developed land in the southern area, and 16 Hopi amilies decided to migrate to the reservation, taking over 40-acre nits of irrigated land.

The Division of Territories and Island Possessions

The territorial areas—Alaska, Hawaii, Puerto Rico, and the Virgin Islands—have been the active, strategic outposts of the American people at war. In the interest of the Nation at large, most of them have endured perils, hardships and losses exceeding anything experienced in the continental United States.

All of these areas are trying to establish a more workable formula for their political relationship with the continental United States. Alaska and Hawaii have both had Statehood bills introduced into the Congress, and Puerto Rico has drafted and had introduced a bill which requests the Congress to authorize the people of the island to decide by a plebiscite whether they shall have independence, statehood or a dominion type of government. The Virgin Islanders are preparing amendments to submit to the Congress which would liberalize their organic act.

We should support these 2½ million American citizens who are trying to evolve a sounder relationship with us and who are, in effect, giving us the opportunity to maintain our leadership as a progressive nation. As you stated recently of the Puerto Ricans: "All Americans are grateful to them for their loyalty and service during the war * * * such loyalty should now be rewarded by the opportunity to reinforce their local government and to settle by free choice their future relationships with the United States."

In addition to support from the mainland in the fulfilment of their political aspirations, it is obvious that the territorial areas will deserve our full cooperation in the restoration of their normal economic life.

In Hawaii, agricultural production was hindered from the beginning of the war by acute shortages of labor and equipment. The flourishing fishing industry was practically suspended, and the great influx of troops and war workers caused a crisis in housing and public health.

Puerto Rico and the Virgin Islands, when shipping had been drastically cut, came very close to mass hunger. Shortages of food and essential consumer goods were critical during the early years of the war in both Puerto Rico and the Virgin Islands; and throughout the war their own agriculture and industry have been seriously handicapped by the lack of equipment, supplies and shipping.

The Philippine Commonwealth suffered great physical damage and severe dislocation of its industry and trade. At the end of the Japanese occupation, it was found that sugar cane production in the islands had been disastrously reduced; many sugar mills had been destroyed; and a violent inflation had set in, originating from the flood of Japanese pesos, and intensified by the dire scarcity of essential goods.

In seeking remedies for their wartime losses and dislocations, the governments and people of these American outposts have proceeded along practical lines. They have shown a readiness to rely to the fullest extent possible on local resources, local devices and local ability. Indeed, one of the significant features of our relations with the territorial areas is the energetic attention given to concrete economic and governmental problems, while at the same time we have engaged in the formulation of a policy looking toward a sound and realistic political relationship.

This direct approach to common problems is characteristic of the close working relationship which the Division of Territories and Island Possessions has helped to develop between the local governments and the mainland. Such activities as those of the Territorial Office of Civilian Defense in Hawaii and the Civilian Food Reserve program in Puerto Rico have strengthened these working relationships during the war. Some of these ties will be broken when the special war services are discontinued. To the normal peacetime problems of economic and governmental development will be added those of recovery from the special losses and dislocations of the war. In dealing with these problems, care must be taken to preserve mutual confidence in inter-governmental cooperation.

The Territory of Alaska, which attracts increasing attention from prospective agricultural settlers, traders, and tourists, will need further assistance in such matters as road surveys, soil management, breeding and feeding of fur animals, experimental fishing, water resources investigations, mineral surveys, topographical mapping, land classification and development of recreational resources. Only by securing such assistance, can the Territory, as well as the 48 States, derive the full benefit from the transfer of population which is likely to occur.

In Hawaii, the problems of housing and public health, which are now extremely critical, will need continued attention for some time after the war. There may be a partial reversal of the wartime influx of workers from the mainland; but, in any case, as a result of the severe impact of the war upon Hawaii's economy, the readjustment of industry and agriculture and the rehabilitation, of returning servicemen and local labor, will present problems calling for real intelligence.

The insular government of Puerto Rico has gone far by its own efforts to encourage the maximum development of resources, to attract suitable industries, to improve labor-employer relations, and to develop sanitation.

In the Virgin Islands, progress is being made toward increased responsibility in the management of local affairs and toward greater economic productivity. But the postwar period will bring difficult problems of readjustment which will be only partially solved by the proposed Federal program for construction of public works, such as health and sanitation facilities. A more complete and explicit policy is needed with respect to political status and economic developmen

In the Philippines, the biggest immediate jobs are the reconstructio of industry, particularly the production of sugar, and the reestablishment of the Commonwealth finances on a sound basis. Difficul questions of war damage compensation and future trade policy wil call for close and farsighted cooperation of the two governments.

In every territory certain economic problems will remain for solution no matter what form of political status may be adopted. It will b fortunate if, as discussions of "statehood," "independence," an "dominion status" proceed, leaders of opinion, in the territories and o the mainland, will continue to give attention to the common economi problems that lie before them.

The War Relocation Authority

The War Relocation Authority, created as an independent agenc in the spring of 1942 and brought under the Department of th Interior in February 1944 had, at the close of this fiscal year, assiste in the permanent relocation of 51,412 persons of Japanese ancestry from the 10 relocation centers which it originally administered.

The original population of these centers was approximately 110,000 The Tule Lake relocation center became a segregation center in th summer of 1943, as a result of the progress of relocation at that time

The chief objective of the Authority has been to return to the mai stream of American life all of those evacuees from the west coast wh have not been denied the right to return by the Department of Justice or by the War Department. Most of these latter are among th 17,454 persons remaining at the Tule Lake Center.

The relocation of eligible evacuees was greatly speeded when the Western Defense Command on December 17, 1944, announced that it would rescind its evacuation order on January 2, 1945. On the day following the announcement, December 18, the Director of the Authority announced that the remaining eight relocation centers would be closed in not less than 6 months nor more than 1 year.

The success of the relocation effort is indicated by the fact that during the year 24,679 evacuees did establish themselves outside of centers. And while the movement back to the west coast was slow immediately after the lifting of the ban, by the end of June, 4,922 individuals had resumed residence in the evacuated zone. In this same period, however, 10,176 persons had relocated in other parts of the United States.

Obstacles to a stronger movement back to the coast were met with an energetic program of assistance, and of authentic information to create a more ready acceptance of the returning evacuees. Prejudice was strong in some areas of the west coast, where acts of attempted violence against evacuees were committed, such as shooting at their homes and planting dynamite. In other instances acts of intimidation were committed. Other serious handicaps were the acute housing shortage and the comparatively large number of evacuees who were in need of public assistance. Farmers among the evacuees also found it difficult to get the necessary equipment to operate their lands.

The well-publicized military record of the more than 20,000 young Nisei men who volunteered for, or were called into the Army after the reinstitution of Selective Service for them, on January 20, 1944, did much to overcome prejudice on the west coast, as did the fact that many of the relocating evacuees went directly or indirectly into war work. Large groups of both citizens and aliens took employment with the Army Ordnance Depots at Tooele, Utah, and Sidney, Nebr.

To overcome the housing difficulty, full time housing experts were attached to various area offices and field offices on the coast, and independent cooperating groups sponsored hostels in key localities in which evacuees could live while finding permanent quarters.

The Authority, in its budget requests, based its needs on an estimated population at its centers of approximately 44,000 by the beginning of the 1946 fiscal year, and as the 1945 fiscal year closed, the population figures were actually close to this total.

Population charts for the centers revealed that a great majority of those who were relocated came from the age group between 18 and 35, leaving the residue of children and older aliens, posing a greater problem in working out relocation plans. Many of the more difficult relocation problems were being solved through the cooperation of Federal, State, and county welfare agencies.

Relocation was materially speeded by the elimination or curtailment of many of the center functions. These included the closing of the schools with the end of the June term, the termination of the agricultural and construction programs, with certain exceptions, and the reduction of maintenance. Mess halls were closed whenever a block population dropped to 125 or fewer. Other functions were greatly restricted as the relocation of persons who were able to work reduced evacuee manpower to a minimum.

By the end of the year a pronounced reluctance on the part of a considerable number of evacuees to leave the centers was being gradually overcome, as they realized that the final closing of the centers was a fixed policy.

The War Relocation Authority completed its first full year of operation of the refugee shelter at Fort Ontario, N. Y., having taken over this responsibility in July of 1944, when approximately 1,000 refugees from Europe arrived there. Problems here were somewhat different from those of the relocation centers. In June the subcommittee of the House Committee on Immigration and Naturalization held a hearing at the shelter to determine the possibility and advisability of extending immigration status to the residents of the shelter, but had not made its findings public as the fiscal year closed. Fourteen of the refugees returned to Europe during the year and another group was preparing to return in August.

The Office of the Solicitor

The Office of the Solicitor, while continuing to carry its regular load of normal departmental legal work and the extra burdens imposed by war activities in fuel, mineral, territorial and other fields, was able to absorb a new and increasingly heavy and important additional legal responsibility in connection with the departmental and general governmental programs incident to peacetime reconversion.

Most of the proposed reconversion programs under consideration by the Congress are closely interwoven with the regular activities of the Interior Department. For example, the regional authority bills, the bills for the disposal of surplus property, the strategic materials stock-piling bill, and the several bills for scientific research and development. The Department's attorneys examined and analyzed all of the reconversion bills, and all others affecting the Department's activities, prepared committee reports, suggested clarifying amendments, arranged for attendance and testimony of Departmental witnesses before Committees of Congress, and generally advised the interested agencies of the Department with respect to the legal significance of proposed legislation as it might affect their particular activities and existing authorizations.

Documents were drafted incident to the seizure and possession of struck coal mines under various executive orders; plans were developed for the orderly return of eligible relocation center residents to normal communities and for the prompt liquidation of war relocation centers. Bureau of Reclamation attorneys prepared 37 basin reports, to be submitted to Congress, providing for comprehensive postwar plans for the development of water, land and hydroelectric power resources, and they were actively engaged in the legal implementation of the Bureau's vast reclamation programs which had been temporarily halted by War Production Board orders during the war. An important victory was won in the case of *United States* v. *General Petroleum Corporation, et al*, involving additional oil royalties to the United States in the Kettleman Hills district, California. Regulations were drafted with respect to such matters as grazing under the Taylor Grazing Act; to provide for the reopening of the national parks on a peacetime scale; to anticipate an expected increase in hunting during the 1945–46 season; to relax wartime control of explosives; to improve the control over departmental patents, and many others. Hearings were conducted in Alaska with respect to Indian aboriginal rights and conferences with territorial and War Department officials culminated in the terminating of martial law in Hawaii. This, briefly, is indicative of the range and variation of the legal affairs that were dealt with through the Solicitor's office.

Conclusion

The foregoing pages provide a documented basis for a truth that can be summed up in a fairly brief sentence: We lack much that we need, and we must get it or else suffer grave consequences in the not very remote future.

If anything remains to be said it is only enough to stress what "we" means, and to point out what the kind of suffering that I have referred to could mean to each one of us.

"We" does not mean the Nation in any life which it may be supposed to live apart from the people themselves. "We" means all of us, and here, if not in Webster, it means each of us. It means we who are free, but who would not be if we were conquered. It means we who have and use a thousand conveniences that are made of metals, but who would not have them if we exhausted our mineral supply.

If we suffered the worst that could befall us, under attack, for a lack of metals we would not merely suffer "an unsuccessful war," nor would we do our suffering academically on a certain page of a school history. We would suffer goosestepping, and we would suffer it in our homes, and in our schools, and in our places of business.

If our shortages of metals were acute enough, even in time of peace, we would not suffer merely from "reduced inventories," or from "a higher cost-of-living index." We would suffer from our inability to get automobiles, refrigerators, washing machines, and other luxuries that have become common place to us, because, in their scarcity, they would be available only at outrageous prices which we could not pay.

All that I can set down by way of a formal conclusion is that the situation with respect to many of the minerals upon which our very manner of living depends is such as to give the United States of America real national concern. If we do not remedy that situation we will most certainly and indisputably wish that we had.

Sincerely yours,

Harold L. Ickes

Secretary of the Interior.

The Bureau of Reclamation

HARRY W. BASHORE, ***Commissioner***

* * *

THE Bureau of Reclamation during the fiscal year maintained at record levels its production of food and power for a fighting Nation, and carried forward its plans for further development of Western resources in meeting the problems of peace.

Food production on Federal Reclamation projects during the war years has been stepped up to the highest levels in history. In 1944 the gross value of food and fiber crops reached an all-time peak.

Power plants operated by the Bureau at its great dams in the West have been a major factor in the rapid expansion of war industries in Western States, and the power output of these plants during the past year totaled almost 14 billion kilowatts, most of which went into production of planes, tanks, ships, and other commodities to sustain our fighting forces in all parts of the world.

While directing major attention to its programs in support of the war effort, the Bureau during the year has also made substantial progress on its plans for undertaking a greatly expanded program for development of Western resources during the postwar period. With the end of hostilities the Nation faces not only the problems of the immediate reconversion period, but also the longer range problem of maintaining a high employment and high production economy at a permanent level. The postwar program of the Bureau of Reclamation is designed to gear into both the reconversion period and the leveling-off period which follows it.

That program, outlined before a congressional committee in April, calls for full development of the agricultural and industrial resources of 17 Western States through construction of multiple-purpose projects to provide irrigation, power production, flood control, and other benefits. The Bureau's postwar inventory of projects listed 415 proposed for construction after the war, including those on which work is under way or authorized and those on which studies are still being made. Construction of these projects, estimated to cost nearly 5 billion dollars at 1940 price levels, would provide thousands of jobs, open new lands for settlement by veterans and others, stimulate the development of new industry, and in many other ways help meet the problems of reconversion and in permanently building for a better stronger America.

The late President Roosevelt, in a letter written a few days before his death to Representative John R. Murdock, chairman of the House Committee on Irrigation and Reclamation, emphasized the importance of Reclamation projects as a means of providing job and farm opportunities for returning veterans. An excerpt from that letter, dated April 10, 1945, is as follows:

> As I stated in my message to the Congress of January 13, 1944, demobilization starts long before the war ends, and it is essential that programs of assistance to veterans be authorized and adequately prepared now. One such program has been under active study and is in the advanced stages of planning through the work of the Bureau of Reclamation, Department of the Interior. I have frequently spoken with pride of the accomplishments of this administration in western Reclamation projects. The great Columbia Basin project in the Northwest, the projects in the Missouri River Basin, and others of equal significance, will, as I said at Chicago on October 28, 1944, be golden opportunities for returning veterans. Such projects constitute great increases in national wealth and income. They also offer splendid opportunities for secure and abundant livelihood to men and women willing to engage in the arduous, though stimulating, tasks of pioneering these latest frontiers. I commend and urge your favorable consideration of Federal Reclamation projects as an important opportunity for returning veterans.
>
> A program to facilitate settlement of returning veterans on farms can be of great value in assisting them in returning to civilian life. It can also be of great value in the reconversion of our national economy to fully prosperous peacetime basis. Full enjoyment of the great productive resources of this Nation by all of the people requires that all have opportunity to engage in productive labor. The purchasing power created by reclamation projects is a stimulus to industry and commerce, thus promoting full employment throughout the Nation. Those engaged in agricultural production should secure ample livelihood so that they can participate in enjoyment of the products created by full industrial employment. Measures in addition to those dealing with Federal Reclamation projects will be needed to round out a comprehensive program in this regard.

Projects included in the Bureau's inventory are integral parts of programs for coordinated resource development on a basin-wide scale in each of 15 major river valleys in the West. The first of these comprehensive studies and reports was completed during the fiscal year for the Missouri River Basin, and the Congress approved the joint plan of the Bureau and the Corps of Engineers by passage of the Flood Control Act of 1944. The postwar inventory includes 29 Bureau projects initially authorized for construction in carrying out this coordinated plan.

Production of food and power on 52 operating projects of the Bureau during the year was maintained at record levels, as was generation of power for war production.

Construction activities of the Bureau were continued during the year on a restricted basis, confined mostly to war food and war power projects approved by the War Production Board. Work was halted by War Production Board stop-orders, or deferred because of the war on ore than a billion dollars worth of construction planned by the ureau. Project planning activities and the preparation of designs nd specifications were also carried forward during the year, primarily n projects included in the postwar inventory. Work was hampered y limited funds and the lack of trained personnel.

The Bureau is now resuming construction on a considerable number f projects. Among those slated for early development are the olumbia Basin project in Washington State, the Central Valley project in California and various projects in the initial development stage or the Missouri Basin. The report on the allocation of costs for the olumbia Basin project was submitted to the Congress during the year nd repayment contracts setting forth the terms under which water sers will repay part of the cost of constructing the irrigation system ere to be submitted to landowners in the Basin at a special election n July.

The Federal Government now has an investment of $952,893,000 in rojects built and under construction by the Bureau of Reclamation. he cost of constructing the irrigation features of the projects actually n operation was slightly in excess of $312,000,000, of which at the end f 1944, more than $71,000,000 had been repaid by water users under eclamation law. The gross value of crops produced on these lands for he single year 1944 amounted to more than the cost of building the rigation systems.

More than 91,000 family-sized farms are provided with irrigation ater through the 52 operating projects of the Bureau, and nearly five illion people live in the areas served with irrigation and power from s systems.

Disruptions caused by the war have affected the work of the Bureau n many ways. More than 1,800 members of its staff, many of them killed technicians, joined the armed services. Operations were ampered by shortages of manpower and materials. Needed repairs nd maintenance work on irrigation systems and power plants were elayed.

An expanded irrigation acreage and development of other resources s necessary to insure the continued growth of the West. In the acific States and several of the Mountain States, population growth as outstripped agricultural production. The drought experiences of he Plains States, on the other hand, point to the need for increased rrigation to stabilize their agriculture and to stimulate development f other resources.

The war has placed a tremendous drain upon our natural resources. t is essential that remaining resources be conserved and utilized to the reatest possible advantage if the Nation is to continue its role of vorld leadership. To this objective the work of the Bureau of Recamation is dedicated.

MISSOURI BASIN DEVELOPMENT

The Congress this year called upon the Department of the Interior and the Bureau of Reclamation to shoulder major responsibility for the biggest single development job in the Nation's history—that of harnessing the Missouri River and putting it to work as a constructive force in expanding the agricultural and industrial frontiers of the West.

The Bureau's program to control and put to greater use the waters of one of the country's most unruly and destructive rivers was approved by the Congress in passing the Flood Control Act of 1944, under which the coordinated plan of the Bureau and the Corps of Engineers for development of the Missouri Basin was adopted. The latter agency will be primarily responsible for flood control and navigation projects. The Bureau of Reclamation, working closely with other agencies of the Department of the Interior, will construct projects for irrigation and power development. The Congress authorized an appropriation of $200,000,000 each for the Bureau and the Corps of Engineers in carrying out the initial phases of the program.

This comprehensive program for coordinated development of Missouri Basin resources surpasses anything of similar nature ever undertaken. It will affect a region embracing approximately one-sixth of the area of the continental United States, extending from the eastern slope of the Rockies in Montana where the Missouri starts its twisting 2,500-mile course, to where it empties into the Mississippi near St. Louis. The drainage area of the river and its tributaries includes 10 States—all of Nebraska, the Great Plains of Montana, North and South Dakota, Wyoming, Colorado, Kansas, parts of Minnesota, Iowa, and Missouri.

The magnitude of the engineering tasks involved in this development program can be realized from the fact that coordinated plans call for the construction of more than 100 dams to create storage reservoirs of 63,000,000 acre-feet capacity, almost equal to the present storage capacity of all present Bureau reservoirs combined. The works to be constructed will provide for irrigation, the development of hydroelectric power, flood control, improved navigation, municipal water supplies, fish and wildlife conservation and opportunities for recreation.

Projects to be constructed under the coordinated plan will aid greatly in stabilizing the agricultural economy of an area which has known the devastating effects of both droughts and floods. The projects proposed will provide for the irrigation of 4,760,000 acres of moisture-famished land never before irrigated, and for supplemental water for 547,000 acres now inadequately irrigated. A total of more than 150 major and subsidiary units for irrigation are contemplated in the seven arid or semiarid States of the Basin. Hydroelectric plants with a capacity of 789,750 kilowatts and a power transmission grid are included. The estimated annual output of the power plants would approximate 4½ billion kilowatt hours.

In the initial stage of the unified plan the Congress authorized the construction by the Bureau of Reclamation of 29 units and a power transmission grid. When completed, these will irrigate 2,836,000 acres, and allow for installed power capacity of 321,000 kilowatts. The Bureau has started work on the plans for the first 11 units with a view to having them ready for beginning of construction in the next fiscal year.

The 29 initial Reclamation projects authorized by the Congress for construction in the Missouri River Basin are:

Kansas-Nebraska: Bostwick, Cedar Bluff, Frenchman-Cambridge, Kirwin, North Republican (Wray) (Colorado-Nebraska), pumping units for underground water in Republican Basin.

Montana: Canyon Ferry Reservoir, Glasgow Bench pumping, Hardin (including Yellowtail Dam), Marias, Missouri-Souris (Montana division), South Bench, and Yellowstone River pumping units.

North Dakota: Heart River, Knife River, Missouri-Souris (North Dakota division), and five Missouri River pumping units.

South Dakota: Angostura, Grand River (Shadehill-Bluehorse), Oahe (James River), and Rapid Valley (including Brennan Reservoir).

Wyoming: Big Horn pumping units, Big Horn project (Boysen Dam), Glendo Reservoir, Kortes, Owl Creek, Paintrock, Riverton, and Shoshone project extensions.

Transmission lines to carry energy generated by Bureau plants complete the list of initial projects.

The table below summarizes by states the irrigation and power development features of proposed Bureau projects under the coordinated plan:

State	New irrigated land	Supplemental supplies	Power plants	Installed capacity
	Acres	*Acres*		*Kilowatts*
Montana	967, 130	346, 800	6	308, 500
Wyoming	281, 560	167, 400	8	217, 000
Colorado	101, 280	1, 719		
North Dakota	1, 266, 440		3	458, 267
South Dakota	961, 210	11, 300	5	510, 500
Nebraska	989, 445	19, 930		
Kansas	193, 335	155		
Total	4, 760, 400	547, 304	22	1, 494, 267

The Flood Control Act, putting the congressional stamp of approval on the coordinated plan for Missouri Basin development, became law in December 1944. Two weeks later the Bureau called key members of its regional staffs at Billings and Denver to Washington for conferences with the Commissioner's staff to map out a program for starting work. A second conference was held at Denver in June at which further plans were made, policies formulated, and the general organizational set-up for carrying out the program agreed upon. Also selected was a group of projects, from among the 29 authorized, on which construction could be started first.

For this comprehensive development job the Bureau will have the assistance and cooperation of many Federal agencies in addition to those in the Department of the Interior, and of State and local organizations in the Missouri Basin. Interior agencies working with the Bureau include the Geological Survey, National Park Service, Fish and Wildlife Service, Bureau of Mines, Office of Indian Affairs, General Land Office, and the Grazing Service, working through the Water Resources Committee of the Department.

Plans for project development are also coordinated through the Federal Inter-Agency River Basin Committee made up of representatives of the Department of the Interior, the War Department, the Department of Agriculture, and the Federal Power Commission. In April, a special subcommittee of this latter agency was set up to deal specifically with Missouri Basin developments. Known as the Missouri Basin Inter-Agency Committee, it is made up of representatives of the 4 Federal agencies named above and 4 governors representing the 10 Missouri Basin States.

The cost of constructing the projects approved under the coordinated plan is estimated at approximately 1½ billion dollars, based on 1940 prices. Many of the multiple-purpose projects to be built would be self-liquidating, and a major portion of the total investment would be returned to the Federal Treasury through payments by water users and through sales of electric power. Construction costs of flood control and navigation projects proposed under the plan would not be directly repayable but yield benefits far in excess of costs.

Construction of the initial projects in the Bureau's program for Missouri Basin development will be started as soon as the Congress makes the necessary appropriations and the manpower and materials become available.

The impact which a completed program of this magnitude will have upon the national economy can readily be imagined. It will provide thousands of jobs for returning servicemen, war workers, and others, not only at construction sites but at supply centers many miles away. The development of irrigation projects will help to stabilize the agricultural economy of a vast area periodically scourged by drought. The availability of low-cost hydroelectric power will stimulate business and industry, make possible development of untapped natural resources, and lighten the burdens of farm and city dwellers. Storage reservoirs to be constructed will minimize greatly the danger of floods in the lower reaches of the river. Approximately 53,000 new irrigated farms will be created. Population will be increased. Purchasing power in the Missouri Basin States for commodities produced in other parts of the country will be expanded by many millions of dollars annually.

FOOD FOR A FIGHTING NATION

Food is as important in war as men and machines are. The men and women on the farms of America are as truly "war workers" as those employed in shops and factories to turn out planes and tanks. And wherever our fighting men have gone on all the battle fronts they have been the best fed, the best clothed, and the best equipped troops ever mobilized.

To make possible that achievement, the farm families of America have made a record in the production of food and fiber that is without parallel in the Nation's history. They have provided not only for the needs of our fighting forces but for our allies and the civilian population here at home.

The part which farmers on lands irrigated by Federal Reclamation projects have played in that record-breaking achievement is outstanding. The value of crops produced on Bureau-irrigated lands has more than doubled during the war years, partly reflected in increased market prices but also due to greatly increased production of war-essential crops and to additional acreage brought under irrigation.

CROP VALUES HIT RECORD LEVEL

During the past fiscal year, more than 4 million acres of land were served with irrigation water from Bureau projects, representing an increase of 759,000 acres over 1941 and 125,000 acres more than in 1943. The value of crops produced hit an all-time high of $411,226,000, compared to $159,886,000 in the pre-war year of 1941.

In meeting wartime food needs, farmers on Reclamation lands during 1944 produced 57,122,000 bushels of potatoes, 1,941,000 tons of sugar beets, 6,495,000 bushels of onions, 3,674,000 bushels of beans, 36,672,000 bushels of grain, and 49,000,000 bushels of truck crops. To maintain production of meat and dairy products at a high level, they also produced 4,360,000 tons of forage crops, including 3,830,000 tons of alfalfa hay. Production of apples, oranges, grapefruit, peaches, and other fruits and berries totaled 729,000 tons, and crops produced for seed amounted to 4,512,000 bushels.

The average per acre value of crops on Bureau-irrigated lands in 1944 was also the highest on record, an average of $99.27 per acre, compared with a per acre average of $47.30 in 1941. The highest average crop value in 1944 was reported for the Tieton division of the Yakima project at $598.34 per acre, closely followed by the Okanogan project at $592.32 per acre. Both are apple-growing districts in the State of Washington.

PROJECTS HAVE $100-PER-ACRE RETURN

Gross crop values exceeding an average of $100 per acre also were reported on the following projects: The Salt River (Arizona); Yuma (Arizona-California); Orland, Imperial Irrigation District and Central Valley (California); Fruitgrowers Dam and the Orchard Mesa division of the Grand Valley project (Colorado); Rio Grande (New Mexico-Texas); Klamath (Oregon-California); Owyhee Ditch Company (Oregon-Idaho); and Provo River and Weber River (Utah).

Tonnage of food and forage crops increased from 10,660,000 tons in 1943 to 11,369,000 tons in 1944. Of the cultivated area 26.1 percent was in alfalfa with production valued at $67,978,000, 4.9 percent in potatoes valued at $50,211,000, and 4.3 percent in seed crops with a value of $24,333,000. Gross value of other crops produced in 1944 were: cotton, $18,446,000; beans, $13,363,000; sugar beets, $20,623,000; truck crops, $59,178,000; grains, $39,610,000; and fruit, $56,140,000. Principal volume increases occurred in alfalfa hay, grains, truck crops, and fruit.

The returns cited are exclusive of the values of livestock fattened on Reclamation projects and of dairy and poultry products. These would increase quoted totals by more than 25 percent.

TABLE 1.—Reclamation areas and crop returns, calendar year 1944 [1]

	Projects entirely constructed by the Bureau				
	Irrigable area [2]	Irrigated area	Land subject to construction charges		
			Net area in cultivation	Crop values	
				Total	Per acre
	Acres	*Acres*	*Acres*		
Total, regular projects	2, 394, 246	1, 918, 829	1, 921, 437	$188, 184, 326	$97. 94
Total, storage projects	521, 724	430, 917	434, 747	31, 062. 852	71. 45
Total, special and Warren Act lands	1, 969, 281	1, 694, 861	1, 664, 069	186, 543, 084	112.10
Additional areas reported:					
Temporarily suspended		53, 295	53, 295	1, 360, 540	25. 53
Leased areas, War Relocation Authority Centers, etc		65, 801	65, 801	4, 075, 562	61. 94
Grand total, 1944	4, 885. 251	4, 163, 703	4. 139, 349	411, 226, 364	99. 27
Grand total, 1943	4, 807, 522	4, 055, 329	4, 014, 346	388, 670, 969	96. 82
Increase, 1943–44, total	77, 729	108, 374	125. 003	22, 555, 395	2. 45

[1] A detailed table of area and returns by individual projects is available on request from the Bureau of Reclamation, Washington, D. C.

[2] Area for which Bureau is prepared to supply water.

NOTE.—Per-acre value based on net area in cultivation.

LANDS LEASED FOR GRAZING

The Bureau had under lease during the calendar year 1944 approximately 964,000 acres, of which 799,000 acres were leased for grazing purposes; 64,000 acres for agricultural use; and 101,000 acres for other special uses. The above figures include 89,195 acres of patented land which have been acquired by the Bureau in connection

Year	Federal irrigation projects [1]				Warren Act lands and special contractors				Entire area			
	Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value	
			For year	Cumulative total			For year	Cumulative total			For year	Cumulative total
		Acres				*Acres*				*Acres*		
1906	22,300	[2] 20,100	$244,900						22,300	[2] 20,100	$244,900	
1907	187,628	[2] 169,000	4,760,460	$5,005,360					187,628	[2] 169,000	4,760,460	$5,005,360
1908	289,549	[2] 260,500	7,635,888	12,641,248					289,549	[2] 260,500	7,635,888	12,641,248
1909	410,628	[2] 369,500	11,920,663	24,561,911					410,628	[2] 369,500	11,920,663	24,561,911
1910	471,423	413,000	12,944,639	37,506,550					471,423	413,000	12,944,639	37,506,550
1911	562,311	470,100	13,086,441	50,592,991					562,311	470,100	13,086,441	50,592,991
1912	614,477	540,000	16,007,134	66,600,125					614,477	540,000	16,007,134	66,600,125
1913	694,142	637,227	15,676,409	82,276,534					694,142	637,227	15,676,409	82,276,534
1914	761,271	703,424	16,475,517	98,752,051					761,271	703,424	16,475,517	98,752,051
1915	810,649	760,035	18,164,452	116,916,503					810,649	760,035	18,164,452	116,916,503
1916	922,821	858,291	32,815,972	149,732,475					922,821	858,291	32,815,972	149,732,475
1917	1,026,663	966,784	56,462,313	206,194,788					1,026,663	966,784	56,462,313	206,194,788
1918	1,119,566	1,051,193	66,821,396	273,016.184	[2] 501,100	[2] 481,600	$35,000,000		[2] 1,620,666	1,532,793	101,821,396	308,016,184
1919	1,187,255	1,113,469	88,974,137	361,990,321	916,313	880,613	64,368,468	$99,368,468	2,103,568	1,994,082	153,342,605	461,358,789
1920	1,223,480	1,153,820	66,171,650	428,161,971	981,940	950,890	47,836,750	147,205,218	2,205,420	2,104,710	114,008,400	575,367,189
1921	1,227,500	1,157,900	49,620,300	477,782,271	1,001,250	969,550	45,288,630	192,493,848	2,228,750	2,127,450	94,908,930	670,276,119
1922	1,202,130	1,169,100	50,360,850	528,143,121	983,290	951,270	33,240,840	225,734,688	2,185,420	2,120,370	83,601,690	753,877,809
1923	1,213,700	1,179,870	65,046,300	593,189,421	1,051,380	993,040	37,557,860	263,292,548	2,265,080	2,172,910	102,604,160	856,481,969
1924	1,290,890	1,216,610	66,488,560	659,677,981	930,670	889,460	43,237,470	306,530,018	2,221,560	2,106,070	109,726,030	966.207,999
1925	1,320,300	1,242,750	77,608,880	737,286,861	1,019,170	951,250	53,655,850	360,185,868	2,339,470	2,194,000	131,264,730	1,097,472,729
1926	1,411,020	1,328,810	60,369,620	797,656,481	1,097,190	949,590	49,750,040	409,935,908	2,508,210	2,278,400	110,119,660	1,207,592,389
1927	1,378,990	1,326,810	70,985,450	868,641,931	1,148,115	1,072,486	61,160,010	471,095,918	2,527,105	2,399,296	132,145,460	1,339,737,849
1928	1,442,080	1,385,560	80,238,800	948,880,731	1,235,020	1,192,030	62,495,320	533,591,238	2,677,100	2,577,590	142,734,120	1,482,471,969
1929	1,483,900	1,420,070	87,559,670	1,036,440,401	1,234,230	1,192,990	72,720,490	606,311,728	2,718,130	2,613,060	160,280,160	1,642,752,129
1930	1,504,810	1,467,097	64,418,940	1,100,859,341	1,286,046	1,254,493	54,654,550	660,966,278	2,790,856	2,721,590	119,073,490	1,761,825,619
1931	1,522,718	1,462,565	40,121,089	1,140,980,430	1,293,889	1,251,830	33,406,340	694,372,618	2.816,607	2,714.395	73,527,429	1,835,353,048
1932	1,555,144	1,506,320	31,165,752	1,172,146,182	1,214,461	1,196,400	18,627,219	712,999,837	2,769,605	2,702,720	49,792,971	1,885,146,019
1933	1,589,770	1,529.903	48,138,576	1,220,284,758	1,239,017	1,199,113	35,425,870	748,425,707	2,828,787	2,729,016	83,564,446	1,968,710,465
1934	1,552,124	1,464,405	59,628,327	1,279,913,085	1,285,081	1,229,594	40,160,676	788,586,383	2,837,205	2,693,999	99,789,003	2,068,499,468
1935	1,640,936	1,604,166	63,601,663	1,343,514,748	1,294,680	1,256,970	43,179,631	831,766,014	2,935,616	2,861,136	106,781,294	2,175,280,762
1936	1,702,192	1,629.174	78,902,818	1,422,417,566	1,335,995	1,272,745	57,599,662	889,365,676	3,038,187	2,901,919	136,502,480	2,311,783,242
1937	1,725,463	1,700,969	72,893,649	1,495,311.215	1,389,338	1,333,800	45,764,623	935,130,299	3,114,801	3,034,769	118,658,272	2,430,441.514
1938	1,777,584	1,764,363	67,859,804	1,563,171,019	1,329,115	1,276,332	45,603,656	980,733,955	3,106,699	3,040,695	113,463,460	2,543,904,974
1939	1,922,868	1.903,269	73,769,654	1,636,940,673	1,218,108	1,174,803	40,313,140	1,021,047,095	3,140,976	3,078,072	114,082,794	2,657,987,768
1940	2,152,808	2,138,927	80,098,196	1,717,038,869	1,238,262	1,177,103	37,690,481	1,058,737,576	3,391,070	3,316,030	117,788,677	2,775,776,445
1941	2,199,179	2,178,288	110,399,806	1,827,438,675	1,140,204	1,202,172	49,486,191	1,108,223,767	3,339,383	3,380,460	159,885,997	2,935,662.442
1942	2,277,955	2,259,653	155,619,716	1,983,058,391	1,602,907	1,562,046	116,428,800	1,224,652,567	3,880,862	3,821,699	272,048,516	3,207,710,958
1943	2,422,288	2,398,922	218,064,208	2,201,122,599	1,633,041	1,615,424	170,606,761	1,395,259,328	4,055,329	4,014,346	388,670,969	3,596,381,927
1944	2,468,842	2,475,280	224,683,280	2,425,805,879	1,694,861	1,664,069	186,543,084	1,581,802,412	4,163,703	4,139,349	411.226,364	4,007,608,291

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[1] Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by United States.

[2] Estimated.

with its projects. Revenues received by the United States for use of land in 1944 totaled $195,805. The majority of the leased lands are withdrawn in connection with operation of completed projects. In addition, more than 700,000 acres of reclamation withdrawn land is now administered by the Grazing Service, with transfer of revenues to the Reclamation Fund. Under an agreement entered into February 28, 1945, between the Bureau and the General Land Office, vacant public lands under reclamation withdrawal may be temporarily transferred to the administration of the General Land Office until needed for reclamation purposes. At the end of the fiscal year, approximately 44,000 acres of such lands had been so transferred.

WORLD'S LARGEST POWER PRODUCER

Through a spectacular expansion in its generating facilities to meet the war emergency the Bureau of Reclamation has become the largest power producer in the world. From plants operating on its projects came nearly 14 billion kilowatt-hours of electric energy during the past fiscal year, much of it to war industries for the manufacture of planes and ships, aluminum, magnesium, and other materials and equipment for the fighting forces. Production of electric energy at Bureau projects has quadrupled since Pearl Harbor.

When the war is over this tremendous capacity for power production will be one of the most important factors in the continued industrial and agricultural expansion of the West. It will provide jobs, stimulate the establishment of new industry, aid in developing mineral resources and, in general, serve as the foundation for the establishment of a more balanced economy throughout the West.

POWER FOR WAR

From its beginning in the power field in 1909 with the 6,000-kilowatt Minidoka project plant in Idaho, the Bureau's installed capacity has grown to 2,439,300 kilowatts. This growth was required to keep pace with the needs for electrical power in areas served by reclamation projects and played a vital role in the tremendous expansion of war industries in the West. To meet demands, the installed capacity of Bureau hydroelectric plants was increased since 1941 by nearly a million and a half kilowatts, a gain of nearly 65 percent.

In the fiscal year 1945 the combined output of the plants operating on Bureau projects was approximately 14,000,000,000 kilowatt-hours. Revenues from the sale of energy were in excess of $20,000,000.

Construction of new plant facilities has been virtually halted since 1942 because of the need for diverting critical materials to other war uses. During the past year an additional 82,500-kilowatt unit was installed in the plant at Boulder Dam, which has supplied a steady tream of energy to aircraft and shipbuilding facilities, magnesium plants, and other basic industries. The plant at Boulder is the world's largest, and has a capacity of 1,034,800 kilowatts. The Shasta Dam power plant in northern California completed its first full year of operation with an output of 739,000,000 kilowatt-hours. Power from Grand Coulee Dam continued to be the mainstay of booming war industries in the Pacific Northwest. More than one-third of the aluminum used in airplane construction in the United States was produced from power generated by the Grand Coulee-Bonneville system. From Grand Coulee also came the large blocks of power for other important war purposes.

During the year the Bureau also completed construction of the 97-mile transmission line to Oroville which made possible the delivery of Shasta power to the connecting lines of the Pacific Gas & Electric Co. and thence into northern California war plants. The company serves as the marketing agency for this power under a wartime contract. The availability of Shasta power resulted in saving thousands of barrels of fuel oil that would otherwise have been required had the same energy been generated by steam plants.

POWER FOR PEACE

The postwar program of the Bureau calls for increasing the capacity of present plants to 4,000,000 kilowatts, principally by adding generating units for which space has been provided in constructed plants. Additional installations at projects included in the postwar inventory call for generating plants which will give the Bureau of Reclamation a total power capacity of about 9,000,000 kilowatts. Of this, about a million and a half kilowatts will be in plants strategically located in states of the Missouri Basin to aid in the further development of that great area.

The demands of wartime have served to emphasize what officials of the Bureau of Reclamation have long recognized—the importance of developing the power resources of our western rivers along with the utilization of their waters for irrigation and other purposes. The availability of such low-cost power is essential on many projects for irrigation pumping, but it is even more important as a stimulant to the development of industry and business to go hand in hand with agricultural expansion in establishing a balanced economy.

Revenues from the sale of such power helps repay to the Federal Treasury a major portion of the cost of constructing many reclamation projects. Without that source of repayment revenue, projects which are now contributing so much to the Nation's agricultural production and providing homes and jobs for thousands of people could not have been constructed without a much greater net cost.

Under reclamation law, most of the investment which the Government makes in these irrigation projects is repaid over a period o from 40 to 60 years by water users, and the revenue from sale of electric energy to municipalities and individuals.

The mighty contribution which the West has made to war production since 1941 would not have been possible without the power-producing facilities of Bureau projects, and after the war they will play an even more important role in developing the great latent resources of the vast area between the Mississippi and the Pacific.

POSTWAR PLANS TO DEVELOP THE WEST

While pushing its programs to aid in winning the war the Bureau of Reclamation also laid a solid foundation for a program to meet the problems of peace. This program was presented to the Congress in April in the form of an inventory of 415 irrigation and multiple-purpose projects which the Bureau is prepared to undertake in further developing the resources of 17 Western States and to provide jobs and farms for thousands of returning servicemen and demobilized war workers.

This inventory of projects included more than 100 which have already been authorized by the Congress, 29 of them as part of the Bureau's coordinated program for development of the Missouri Basin.

Construction of these authorized and proposed projects would provide jobs at peak employment for more than 400,000 workers at construction sites and a great many more workers in factories, mines, and transportation systems throughout the country.

The cost of constructing these projects—those authorized and those under study—is estimated at close to 5 billion dollars, based on 1940 costs. The estimated construction cost to complete projects already authorized by the Congress is $1,337,701,000.

Nearly 200,000 irrigated farms would be made available for settlement by veterans and others upon the completion of these projects. They would bring water to nearly 11 million acres which have never before been irrigated, and supplemental water to an additional 11 million acres which now have inadequate water supplies. Thus, a total of 21 million acres would be served in stabilizing the agricultural economy of these 17 Western States and contributing to the welfare of the Nation as a whole.

Another very important contribution which these projects would make in developing the resources of the West to the benefit of the whole country is the tremendous increase in the output of electrical energy which would be made possible by harnessing these western rivers through multiple-purpose projects. Power plants on Bureau projects now have an installed capacity of 2,439,300 kilowatts, with a total output in 1944 of nearly 14 billion kilowatt-hours. The postwar program calls for increasing the capacity of present plants to 4,863,000 kilowatts principally by adding generating units for which space was provided in original construction. Additional installations in the postwar inventory call for the addition of generating units which would give Bureau of Reclamation plants a total capacity of 9,324,000 kilowatts.

A summary of the Bureau's postwar inventory of projects is given below:

State	Number of projects	Irrigation		Power		Over-all remaining costs, 1940 prices
		New lands	Supplemental water	Installation authorized projects	Estimated firm projects under study	
		Acres	*Acres*	*Kilowatts*	*Kilowatts*	
Arizona	19	383, 050	602, 800	225, 000	1, 877, 200	$1, 268, 219, 000
California	37	2, 233, 900	4, 475, 000	686, 500	627, 400	836, 494, 000
Colorado	21	797, 385	1, 981, 740	144, 900	574, 000	525, 017, 000
Idaho	22	319, 180	1, 163, 715	100, 500	138, 620	190, 142, 200
Kansas	11	202, 948	674	--------	--------	78, 322, 000
Montana	96	1, 127, 526	294, 500	252, 000	31, 000	265, 273, 000
Nebraska	16	337, 922	57, 430	2, 000	75, 000	77, 955, 000
Nevada	13	67, 100	110, 500	--------	16, 000	39, 609, 000
New Mexico	14	132, 770	194, 380	--------	102, 400	143, 626, 000
North Dakota	14	1, 214, 805	--------	139, 750	--------	137, 438, 500
Oklahoma	11	187, 000	600	--------	--------	39, 184, 000
Oregon	21	468, 515	167, 500	--------	7, 800	97, 353, 200
South Dakota	11	934, 690	25, 300	143, 000	600	125, 406, 000
Texas	13	442, 530	430, 270	18, 000	--------	135, 797, 000
Utah	23	100, 760	272, 969	8, 600	124, 700	181, 472, 000
Washington	5	1, 116, 000	252, 000	852, 000	622, 000	411, 488, 000
Wyoming	68	743, 000	587, 700	40, 000	75, 000	239, 576, 000
Total	[1] 415	10, 809, 081	10, 617, 078	2, 612, 250	4, 271, 720	4, 792, 371, 900

[1] Total includes individual units of some major projects. Miscellaneous projects not included.

The speed with which construction of these projects can be undertaken will depend largely upon the action of the Congress in making the necessary appropriations and upon the availability of manpower and materials. Work is in progress under war food and war power programs on many of the authorized projects and work on others has been halted or deferred because of the war.

The development program proposed by the Bureau is important both from the standpoint of what it can do toward helping the Nation in meeting some of the immediate reconversion problems, and also because of its promise for long-range development of the agricultural and industrial resources of the West. It is a program that permits a quick get-away. Provided with funds and manpower to complete field investigations and preconstruction work, as well as appropriations for actual construction, the Bureau could put from 150,000 to 200,000 men to work at project sites the first year. Peak on-site employment could be reached in the second or third year. Although construction would be centered in the Western States, more than half of the resulting employment would be in mines, mills, and factories of the

Midwest, East, and South. It would mean jobs for thousands of workers in manufacturing materials and machinery—iron and steel products, cement, electrical equipment and supplies, foundry and machine-shop products, and lumber, from their beginning as raw materials, their transportation to the factory for fabrication, their processing, and again their transportation to the place where they are used. Thus every State is affected by western construction.

The benefits that would be derived from these projects would not end with the construction of the engineering works but go on for generation after generation to increase agricultural production, stimulate industry, increase purchasing power, create new opportunities for business, trade and professional people in towns serving project areas. So not only the West but the entire Nation would be benefited permanently.

For 43 years the Bureau of Reclamation has been working on programs for developing the land and water resources of the West. The value of those developments has been effectively demonstrated during the war. The need for continuing and expanding such developments has also been demonstrated. At present there are about 2½ million more people living in the 11 far Western States than there were before the war. This is a population increase of 17.8 percent, compared with a national increase in the same time of only seven-tenths of 1 percent. Many of these new residents of the West will remain in the region. In addition more than 1,000,000 western boys will be demobilized from the armed forces. They will want jobs, they will want opportunities to start farming, to practice their trades and professions, to open business establishments. An increase in the basic irrigated agriculture of this area will therefore be necessary to support and sustain the growth and the continuing industrial expansion of these States. It is to meet this challenge and to open up a new frontier of opportunity in the West that the Bureau of Reclamation presents its postwar program.

RIVER BASIN STUDIES PROGRESS

The Branch of Project Planning gave major attention during the year to projects proposed for construction after the war.

Field staffs concentrated on the completion of the comprehensive engineering and economic investigations and reports on 15 major river basins in the West, in addition to sub-basin and project studies. The objective of these studies is to present a comprehensive and over-all plan of development on a basin-wide scale to bind the various projects and units into an orderly and logical program for the most effective utilization of land and water resources.

The first of these basin reports—covering the Missouri River Basin—was presented to the Congress last year (S. Doc. 191). Further studies of projects and sub-basins in the Missouri Valley are continuing. Reports on other major western river basins in various stages of completion by the Bureau are: Columbia River Basin, Rogue River Basin, Central Valley, Santa Barbara County, Russian River Basin, Lower Colorado River Basin, Upper Colorado River Basin, Great Salt Lake Basin, Nueces River Basin, Rio Grande Basin, Red River Basin, Pecos River Basin, Guadalupe River Basin, Colorado River (Texas) Basin, and Arkansas River Basin.

SPECIAL STUDIES TO AID SETTLERS

In addition to these basin reports and studies of individual projects n the postwar inventory, the Bureau brought to substantial completion during the year its special studies of the two largest Reclamation projects on its postwar development schedule, the Columbia Basin project in south-central Washington and the Central Valley project in California.

Published during the year were 3 of the 28 special reports prepared by the Columbia Basin Joint Investigations Committees—Types of Farming, Rural Recreational Areas, and Insuring Proper Land Use. Additional studies in the series are scheduled for publication during the coming fiscal year.

Also completed during the year were similar special studies for aid to settlers on the Central Valley project. The studies embrace a great volume of factual material on all phases of the proposed development of the project and were prepared by the Bureau in cooperation with a great many Federal and State agencies. Publication of some of the Central Valley studies is also planned for next year.

CONSTRUCTION ACTIVITIES LIMITED

Construction activities of the Bureau continued during the year on a restricted basis, confined almost entirely to projects under war food and war power programs.

The 37-mile Madera Canal on the Central Valley project was completed late in the fiscal year. It will provide water for irrigating about 20,000 acres of new land and supplemental water for 80,000 acres in the fertile San Joaquin Valley. An application to start construction on the 160-mile Friant-Kern Canal was pending before the War Production Board. Twenty-nine projects were cleared under the war food program.

Ten dams were partially completed at the end of the year, as follows:

Concrete dams

Dam	Reservoir capacity	Height	Complete
	Acre feet	*Feet*	*Percent*
Altus	151, 650	110	98
Keswick	23, 689	130	85

Earth dams

Dam	Reservoir capacity	Height	Complete
Anderson Ranch	500, 000	456	60
Newton	5, 500	101	97
Deerfield	15, 000	120	75
Scofield	65, 000	68	50
Wickiup	180, 000	100	80
Box Butte	31, 500	66	75
Jackson Gulch	10, 000	180	20
Shadow Mountain	15, 000	48	60

A total of 144 miles of transmission lines was completed and construction of an additional 308 miles was in progress. Fifty miles of canals were built and work on other water distribution facilities for war food production was continued. Construction during the year involved the use of more than 300,000 barrels of cement, and 220,000 cubic yards of concrete were placed.

Construction of Anderson Ranch Dam on the Boise project in Idaho passed the half-way mark. When completed it will be the highest earthfill dam in the world. The reservoir created will provide flood control, and store irrigation water for 290,000 acres now receiving an inadequate supply. On the Deschutes project in Oregon an earth dam is under construction to provide irrigation for approximately 20,000 acres, and construction also was continued on the canals and distribution system for irrigating 32,000 acres on the Yakima Roza project in Washington.

Clearance was granted for the installation of additional equipment for the power plant and for emergency repair work on the spillway bucket at Grand Coulee Dam. On the Tucumcari project in New Mexico, work was completed on the first section of the Conchas Canal to provide irrigation water for an initial block of 7,000 acres.

Construction also progressed on the Gila project in Arizona and on the Coachella Canal in Southern California. Other construction included guniting over the dry rock paving in the desilting basins at the headwaters of the All-American canal, preparation of the designs and specifications for the construction of the $17,000,000 San Diego Aqueduct, continued construction on the Salt Lake Aqueduct, flood control work on the Colorado River, and concrete lining work on the 13-mile Alva B. Adams Tunnel under the Continental Divide.

A limited program of construction was also carried on at Green Mountain and Shadow Mountain Dams on the Colorado-Big Thompion project in Colorado, and on the following projects cleared for construction under the war food program: Rapid Valley, S. Dak., Newton and Scofield, Utah, Mirage Flats, Nebr., Mancos, Colo., and Lugert-Altus, Okla.

DESIGNS PREPARED FOR POSTWAR PROJECTS

The Branch of Design and Construction concentrated on the preparation of designs for postwar projects, so that work might begin on a considerable volume of construction whenever war conditions permit. In planning for this postwar development of land and water resources, preliminary designs and estimates were made for 15 concrete and 10 earth dams, 40 power plants, 9 pumping plants, 2 water supply systems, and for canals and water distribution facilities on 15 projects. In addition to these, design studies were started on features of numerous other postwar Reclamation projects.

Primarily, construction work on projects authorized by the War Production Board has been for the purpose of food and power production. The War Production Board authorized work on 21 Bureau projects during the fiscal year, but due to labor and materials shortages, some projects did not progress as planned. Efforts to conserve critical war materials has resulted in increased construction costs on some project features and at times has necessitated design changes.

TECHNICAL ADVANCES

Outstanding technical advances included the development of the hollow-jet regulating valve, and the development of the transformer reactance voltage-drop compensator. The hollow-jet valve will provide more economical installation and maintenance and improved operation for water outlet regulation. The voltage-drop compensator permits the adjustment of electric potential measuring devices in about one-tenth the time required by previous methods. During the year an inexpensive integrating machine was developed which will materially facilitate computations for design where differential equations are involved and which has possibilities for application in mathematical studies elsewhere.

BUREAU AIDS OTHER UNITED STATES AGENCIES

During the war, Bureau engineering and laboratory personnel and facilities were called upon to assist the War and Navy Departments, as well as other Government agencies and private corporations concerned with the war program, in solving a wide diversity of numerous technical engineering problems.

The Bureau cooperated with the Bureau of Mines by furnishing power for research, and with the Geological Survey in exploration for strategic minerals, by providing technical assistance and laboratory facilities. The Bureau cooperated also with the War Department, the Geological Survey, and the Department of Agriculture in the interchange of information and technical data.

WORLD'S BIGGEST DAMS

The engineering accomplishments of the Bureau of Reclamation are known the world over. Its engineers have tamed the mightiest rivers in the West and put them to work at transforming barren lands into productive farms and to producing power for industry. The three biggest concrete dams in the world have been built by the Bureau of Reclamation—Grand Coulee Dam on the Columbia River in Washington, Shasta Dam on the Sacramento River in California, and Boulder Dam on the Colorado River between Arizona and Nevada.

The Bureau has built 15,495 miles of irrigation canals—enough to cross the continent five times. The storage reservoirs behind its dams have a capacity of 66,558,840 acre-feet. It has built 347 tunnels with a combined length of 560,271 feet. Operating on its projects are 31 hydroelectric plants with an installed capacity of 2,439,300 kilowatts, part of the energy produced being marketed over 2,164 miles of transmission lines built by the Bureau.

In the construction of its projects the Bureau has excavated 606,313,120 cubic yards of earth and rock, poured 33,671,861 cubic yards of concrete, used 38,289,133 barrels of cement. It has built 209,016 canal structures, 5,196 miles of waste water ditches and drains, 13,676 bridges, 23,620 culverts, 6,310 flumes with a combined length of 873,989 feet, and 331 pumping plants.

OPERATION AND MAINTENANCE PROGRAM

Operation and maintenance activities on the 52 operating Federal reclamation projects were devoted first and foremost to furnishing the irrigation service needed to maintain record-breaking agricultural crop production. The stabilization of these projects to protect the Federal investment is important, as are also steps which have been taken to aid in assuring the success of the water users through improved irrigation practices, land-use and related activities, including settlement.

A special effort was made again during the year to provide for the full use of Reclamation withdrawn lands for grazing purposes to support the livestock production in the West.

Activities carried on in the field by this branch of the Bureau of Reclamation for the benefit of water users and to facilitate project operations included: (a) programs for improved operations of projects and preparations for operations, land use, and settlement on projects under construction or authorized; (b) land reclassifications; (c) thorough economic analyses in connection with the negotiation of amendatory repayment contracts and the deferment of construction charges. Plans for the land purchase, development and settlement of the Columbia Basin project were a major goal. Cooperation with State agricultural colleges and other agencies was advanced.

Field work was completed or in progress on the reclassification of irrigable lands on 16 projects or divisions of projects, involving approximately 309,000 acres.

FIELD ORGANIZATIONS ESTABLISHED

Progress was made during the year in setting up operation and maintenance organizations in regional offices. This was in line with the decentralization program of the Bureau to place supervision and contacts closer to operations and to the water users affected, and also to prepare for accelerated operation and maintenance programs that will be needed with the end of the war in connection with project settlement.

The Operation and Maintenance branch was transferred from Denver to Washington during the year. The work of the branch has been primarily directed at (1) the delegating of direct supervisory responsibility of field operations to regional and project offices, (2) development of programs with emphasis on land-use and "the human side" of reclamation, particularly with respect to aiding veterans in settling on irrigated farms, and (3) the review of repayment contracts to determine the need for adjustment in repayment schedules, based on the ability of water users to meet such payments.

AMENDATORY REPAYMENT CONTRACTS

Section 17 (b) of the Reclamation Project Act of 1939 authorized temporary relief from payment of accrued construction charges for each of the years 1939 to 1943, inclusive, in cases where such payments could not be met due to circumstances beyond the control of water users. During the fiscal year, five water users' organizations submitted applications for relief from payments totaling $209,001.30. Four of the five requests concerned 1944 construction installments. No legislation existed for consideration of these requests until passage of Public Law 39 (79th Cong., 1st sess.) on April 24, 1945.

Action taken during the fiscal year to defer construction charge payments granted relief to five water users' organizations, for 1942 and 1943 installments, in the total amount of $208,214.41. Postponements of payments were recommended due to the critical financial condition of the applicant irrigation districts as a result of shor growing season, grasshopper infestation, hailstorms, low productio influenced by labor shortages, and other factors. At the close o the fiscal year five applications as to 1944 charges, as well as on request for deferment of 1943 charges, were awaiting final action.

An inventory was prepared early in the year of repayment contract in force, to be used in the various regions in negotiating amendatory provisions of such contracts. To date, 10 amendatory contracts hav been executed under provisions of the Reclamation Project Act of 1939

WATER CONSERVATION AND UTILIZATION PROGRAM

Work was continued on six projects authorized for constructio under this program before the war, and on two new projects on whic construction was initiated during the year. Preconstruction activitie were under way on four additional projects approved under the wa food program.

Projects under construction were: Mirage Flats (Nebraska), Buffal Rapids No. 2 (Montana), Newton (Utah), Rapid Valley (Sout Dakota), Mancos (Colorado), Intake (Montana), and the Post Fall unit of the Rathdrum Prairie project (Idaho). Other Water Conservation and Utilization projects cleared for construction are Missoula Valley (Montana), Dodson Pump Unit, Milk River project (Montana), Bitter Root (Montana), and Balmorhea (Texas).

Construction remained at a standstill on the Eden project (Wyoming) and the Fallon Unit of the Buffalo Rapids project (Montana) because of War Production Board stop orders.

WAR RELOCATION CENTERS

Three relocation centers continued to operate on Bureau projects during the year. These projects in 1942 became sites for hastily constructed barracks-cities to care for more than 35,000 persons of Japanese ancestry evacuated from the West coast. The centers are operated by the War Relocation Authority on the Heart Mountai Division of the Shoshone project (Wyoming), Gooding Division of the Minidoka project (Idaho), and the Tule Lake Division of the Klamath project (California-Oregon).

The population at the first two of these centers has been greatly reduced during the past year through the efforts of the War Relocation Authority in providing resettlement opportunities for evacuee families in many parts of the country. As a result, most of the acreage in project lands used by residents of the centers to provide food for their own needs, is being turned back to the Bureau.

The Bureau in turn is leasing this land to private operators for continued production of food and forage crops. Both the Heart Mountain and Minidoka centers are scheduled to be closed within the next few months. Part of the irrigation system on each project was developed under the direction of Reclamation engineers, with construction work and farm operations carried on by the evacuees.

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On four other Reclamation projects Civilian Public Service crews, under the Selective Service program, have helped to relieve labor shortages in continuing construction and development work. At the Mancos project (Colorado) an average of 149 Civilian Public Service workers were employed during June. Construction of Deerfield Dam on the Rapid Valley project (South Dakota) was continued by Civilian Public Service labor, a 150-man camp being maintained. Approximately 95 Civilian Public Service assignees were employed on the Deschutes (Oregon) project. These men were used for firefighting, operation and maintenance, and clean-up work. During the irrigation season the Department of Agriculture Camp furnished a few Civilian Public Service assignees for similar work on the Buffalo Rapids project (Montana). There were not enough workers available, however, to advance construction on the project.

PLANS FOR VETERAN SETTLEMENT

The branch was actively engaged in developing a program for the settlement of veterans and others on public lands on projects for which irrigation facilities are constructed and in helping irrigation districts and local interests to advance settlement on privately owned lands in projects under construction. Restricted construction of irrigation facilities during the war limited the settlement opportunities that could be made available in 1945–46, but resumption of construction work was expected to increase materially the number of irrigated farms on public and privately owned lands that could be offered. Preference is provided for veterans under existing law in settlement of public lands.

TABLE 3.—Settlement and economic data—1944

State	Project	Irrigated farms		Towns on or tributary to the project		Number of schools	Number of churches	Banks			Special Warren Act contractors	
		Number	Population	Number	Population			Number	Deposits	Number of depositors	Irrigated farms [1]	Population
	REGULAR											
Arizona	Salt River	12, 714	38, 000	12	180, 015	98	165	7	$156, 059, 766	90, 000	858	5, 529
	Gila [2]	3										
Arizona-California	Yuma	1, 690	3, 065	5	18, 590	14	34	3	(4)			
California	Orland	684	1, 959	1	1, 400	5	12	1	3, 030, 000	2, 800		
Colorado	Grand Valley [3]	513	1, 387	6	19, 950	17	40	3	16, 632, 813	11, 603	803	6, 110
	Uncompahgre	1, 801	5, 106	3	8, 140	28	35	4	7, 127, 115	6, 825	171	339
Idaho	Boise	4, 236	15, 250	16	55, 865	118	131	3	(4)		4, 764	19, 516
	Minidoka	3, 538	11, 568	10	14, 623	36	73	6	(4)		9, 708	44, 065
Montana	Bitter Root	320	1, 136	5	4, 224	18	13	4	5, 908, 108	5, 796		
	Frenchtown	43	185	1	100	1	1					
	Huntley	644	1, 377	5	632	7	6	1	465, 917	450		
	Milk River	676	2, 536	15	10, 939	29	38	7	15, 724, 072	8, 556		
	Sun River	1, 009	2, 543	5	882	10	15	1	(4)			
Montana-North Dakota	Lower Yellowstone	680	2, 171	7	4, 225	17	22	3	5, 703, 865	4, 800		
Nebraska-Wyoming	North Platte	2, 747	7, 815	16	27, 839	72	67	9	25, 180, 973	18, 500		
Nevada	Newlands	766	2, 297	4	2, 920	16	12	1	2, 866, 731	2, 752		
New Mexico	Carlsbad	463	2, 106	4	20, 900	14	20	2	8, 917, 952	8, 000		
New Mexico-Texas	Rio Grande	6, 063	27, 481	40	136, 570	84	184	6	109, 115, 353	57, 136	129	1, 290
Oregon	Umatilla	402	1, 452	4	1, 973	7	15	1	2, 742, 090	2, 550	39	74
	Vale	520	1, 789	4	1, 300	8	14	1	2, 244, 152	1, 750		
Oregon-California	Klamath	969	2, 886	5	32, 418	30	35	4	(4)		544	1, 600
Oregon-Idaho	Owyhee	1, 530	6, 000	8	14, 860	12	18	6	(4)		229	925
South Dakota	Belle Fourche	611	1, 895	5	3, 865	25	23	3	6, 405, 000	6, 340		
Utah	Strawberry Valley	2, 000	8, 700	13	18, 500	29	30	4	8, 500, 000	8, 100		
Washington	Okanogan	395	1, 000	3	4, 920	8	8	2	5, 064, 631	3, 400		
	Yakima	5, 179	19, 838	24	57, 895	76	87	8	23, 252, 240	17, 544	4, 386	17, 499
Wyoming	Kendrick			7	24, 500	17	21	2	15, 000, 000	11, 000		
	Riverton	500	1, 464	3	2, 768	4	19	1	2, 414, 000	1, 900	2	9
	Shoshone	1, 034	1, 997	5	3, 311	3	15	1	2, 931, 196	2, 200		
	Total	51, 730	173, 003	236	674, 124	803	1, 153	94	425, 285, 974	272, 002	21, 633	96, 947

	PROJECTS											
California	All-American Canal:											
	Imperial Valley	4, 511	27, 100	8	40, 600	63	26	6	(4)			
	Coachella Valley	410	6, 750	4	7, 150	9	12	2	7, 350, 000	4, 100		
Colorado	Fruitgrowers Dam	75	375	1	400	2	2					
	Pine River	335	1, 200	5	976	20	12	1	500, 000	500		
Idaho	Minidoka (Fremont-Madison irrigation district).	811	4, 302	11	8, 740	21	30	3	5, 962, 420	7, 428		
Nevada	Humboldt	108	324	1	1, 300	3	4	1	2, 200, 000	1, 500		
	Truckee River Storage	1, 270	2, 700	2	32, 000	21	21	3	33, 000, 000	22, 500		
Oregon	Baker	40	150	1	8	4						
	Burnt River	118	425	8	2, 500	8	4	1	491, 400			
	Deschutes (Central Oregon irrigation district).	699	2, 125	3	15, 500	23	32	4	5, 000, 000	6, 000		
	Stanfield	160	482	1	500	1	3					
	Westland	98	201									
Utah	Hyrum	518	1, 530	3	3, 800	5	6					
	Moon Lake	654	2, 500	10	3, 700	15	23	1	1, 300, 000	2, 500		
	Newton	135	400	3	1, 200	2	2					
	Ogden River	1, 100	4, 300	8	80, 000	34	60	4	40, 000, 000	36, 000		
	Provo River (Deer Creek Division).	1, 260	3, 000	5	37, 250	24	47	6	17, 528, 333	20, 681		
	Sanpete	227	1, 100	2	3, 000	5	4	1	800, 000	900		
	Weber	3, 000	15, 000	21	27, 000	31	26	8	50, 000, 000	40, 000		
	Total	15, 529	73, 964	97	265, 624	291	314	41	164, 132, 153	142, 109		
	WATER CONSERVATION AND UTILIZATION PROJECTS											
Montana	Buffalo Rapids, Unit 1	141	354	2	5, 125	6	14	3	6, 364, 151	4, 772		
	Grand total	67, 400	247, 321	335	944, 873	1, 100	1, 481	138	595, 782, 278	418, 883		

[1] Farms furnished partial or whole water supply by Bureau-constructed works.

[2] Two farms in predevelopment program; 1 farm leased.

[3] Gravity division only; does not include Orchard Mesa irrigation district.

[4] Data not reported.

REGIONAL ACTIVITIES EXPANDED

Substantial progress was made during the year toward completing the Bureau's program of decentralization and in expanding the activities of seven regional offices set up under that program. Inaugurated in September 1943 the regionalization of the Bureau is designed to coordinate activities in each of the major watersheds of the West, and to place supervision closer to the field of operations. A summary of the most important activities in each of the regions is given below:

REGION 1

Fourteen operating Bureau projects in the Pacific Northwest produced crops valued at $178,265,000 during the crop year of 1944, and power plants operated by the Bureau delivered almost 6 billion kilowatt-hours of electric energy to war industries. This region includes the States of Washington and Idaho, all but a small portion of Oregon, part of western Montana, and small areas in Wyoming and Nevada.

The gross value of crop returns on Bureau projects in this area in 1944 exceeded 1943 by $7,890,000 and averaged $99.44 per acre. In addition to many other food crops, the irrigation farmers of the region raised 40,234,832 bushels of potatoes, an amount sufficient to provide a year's supply for 19 million persons; 838,517 tons of sugar beets, sufficient to provide 8 million persons with a year's supply of sugar; and 1,648,360 tons of alfalfa, which, on being fed to beef and dairy herds, provided the equivalent of an annual supply of milk for 2¼ million persons plus an annual supply of beef for 2½ million persons.

In the production of power, the four Bureau multiple-purpose projects in the Northwest produced 5,894,969,245 kilowatt-hours of energy during the 1945 fiscal year. This production to a large extent made possible the huge output of aluminum and other war supplies in the area.

Largest of the power producers was Grand Coulee Dam with an output of 5,716,661,000 kilowatt-hours. There was a steady growth in this project's contribution to war industries consuming huge blocks of electrical energy, and the total output since operations were started in March 1941 amounted to approximately 15,232,375,000 kilowatt-hours by the end of the fiscal year. Although the present installation of the power plant is less than half its ultimate capacity, it continues to hold the unchallenged world's record for producing the largest quantity of hydro power in a single month: 621 million kilowatt-hours in March 1944.

Construction activities continued on a curtailed basis during the year. Work on Anderson Ranch Dam on the Boise project passed the half-way mark. On the Post Falls unit of the Rathdrum Prairie project in Idaho work was going forward on construction of a pumping lant and discharge line. An earth dam and canals are being built n the Deschutes project in Oregon, and work was resumed under ie war food program on canals and distribution system for the akima-Roza project in Washington.

The Northwest is mindful of this wartime food and power produc-on record as it regards the Bureau's inventory of new projects for ie postwar period and analyzes the significant features of that iventory.

Forty-seven potential developments in the States of Idaho, Oregon, Vashington, and western Montana are "inventoried," and many of iese would be multiple-purpose in scope. They would bring under rigation 1,970,195 acres of new land, provide a supplemental supply o 1,552,855 acres now suffering with shortages, add 1,084,500 kilo-atts of installed capacity in existing Bureau power plants, and rovide 753,420 kilowatts of new firm power on projects under study.

REGION 2

An increased production of food for military and civilian needs nd of electric power for war industries marked operations of Bureau rojects in region 2, largest of which is the Central Valley project. he region includes three-fourths of California and a small area in regon. Construction was completed during the year on the 37-mile ng Madera Canal to provide water for irrigating approximately 00,000 acres of land in the fertile San Joaquin Valley. The power lant at Shasta Dam, completing its first full year of operation, enerated 739,000,000 kilowatt-hours of electricity to turn the wheels f California's wartime industry.

While contributing to the war program, the region also moved ahead vith its plans for meeting the problems of peace. Thousands of obs will be created and hundreds of irrigated farms made available or settlement through further development of the Central Valley roject and 36 other projects included in the Bureau's postwar in-entory. The first of these projects on which work will start in the nmediate future is the 156-mile Friant-Kern Canal. The War roduction Board approved construction of the initial 5.6-mile sec-ion in June. The canal, when completed, will extend from Millerton ake, the reservoir created by Friant Dam, to the Kern River near akersfield, to provide water for irrigating 358,000 acres of new land n the highly productive San Joaquin Valley and supplemental water or an additional 374,000 acres threatened by shortages.

Millerton Lake, the reservoir created by Friant Dam, reached full apacity and overflowed the spillway of the dam for the first time on une 30. Storage capacity of the reservoir for irrigation and flood ontrol purposes will be increased by 83,000 acre-feet with the installa-ion of three drum gates and other control facilities on the spillway section of the dam. Contracts for this installation are scheduled t be let early in the next fiscal year. The reservoir in 1944 provide water for irrigating 32,500 acres of land for crops and 110,000 acre for pasture land for more than 140,000 head of cattle. Wate marketing contracts were in process of negotiation with 12 irrigatio districts in the San Joaquin Valley as the fiscal year drew to a clos

The Bureau has also initiated negotiations with several municipal ties in the Sacramento area for a larger market for power generate at Shasta Dam. Although the plant operated at only two-fifths its ultimate capacity during the year because the war deferred installation of full generator capacity, its output represented a saving o 1,400,000 barrels of oil which would have been consumed as fuel b steam-plant production of the same amount of power. An application was pending before WPB for the return to Shasta of two 75,000 kilowatt generators "loaned" to the Coulee Dam plant because o the war emergency. Release of water from Shasta Reservoir helpe provide for irrigation needs in the Sacramento Valley, enabled farmer to double the acreage of rice, and helped protect $14,500,000 worth o crops by controlling salt-water intrusion in the delta. Record crop were grown on the Klamath project in southern Oregon and 16,30 carloads of food were shipped.

Work was continued during the year on plans for postwar developments in the region and on preparation of comprehensive reports o projects and river basins. The Central Valley Basin report was i final stage of completion, recommending a program which woul double the irrigated acreage in Central Valley through constructio of 38 reservoirs for storage of 30,000,000 acre-feet of water now largel wasted. Cost of the program is estimated at $1,800,000,000 base on 1940 prices, and benefits from such development would amoun to an estimated $275,000,000 annually. The report on Santa Barbar County investigations has been completed and is now in Washingto for review. Joint investigations by the Bureau and the Corps o Engineers on the Salinas and Russian River Basins are in progress Plans also progressed during the year for developing the recreationa facilities of Millerton Lake and Shasta Reservoir, the work to be unde the general direction of the National Park Service.

REGION 3

This region is the "powerhouse" without which the record production of war industries in southern California would not have been possible. From the giant power plant at Boulder Dam alone, came 6 billion kilowatt-hours of electric energy used in turning out planes and ships, in processing magnesium, and in producing other equipment and materials so vital to the war effort. From the farms irrigated by Bureau projects in this area, which embraces the State of Arizona, outhern California, and small portions of Nevada, New Mexico, and Utah, also came great quantities of food for the armed forces and the ivilian population.

More than half of the electric power used by war industries in this egion was produced at Bureau-operated hydroelectric plants, of which he one at Boulder Dam on the Colorado River is the largest in the orld. An additional 82,500-kilowatt generator was added to the lant during the year, bringing its total capacity to 1,036,000 kilowatts. ts output of 6 billion kilowatt-hours of energy yielded a revenue of 8,574,300. Including the power output at two smaller plants, one at Parker Dam below Boulder, the other on the Yuma project in Arizona, total of 6¾ billion kilowatt-hours of energy was produced.

Region 3 continued its substantial contribution to the Nation's ar food supply. Crop production, for the calendar year 1944 from 43,018 acres served by Reclamation facilities, was valued at $112,780,37 and exceeded by $3,407,259 the record production established by he region's farmers in the previous year.

On the 150,000-acre unit of the Gila project (Arizona), approved for onstruction, leveling operations were completed on 5,000 acres of ublic land in the 8,500-acre tract cleared by the War Production Board as a dust control project for the important Yuma Air Base. Over 1,300 acres are now in alfalfa and the remainder of the public and will be seeded to a sudan grass cover crop during the summer and o alfalfa in the fall of 1945. On the All-American Canal project (California), construction was progressing rapidly at the end of the ear on the Coachella Canal which will bring water to 22,000 acres.

Members of the region 3 staff and other Bureau personnel have also een in charge during the past year of preconstruction surveys and the reparation of designs and specifications for the $17,500,000 aqueduct o provide a water supply for the city of San Diego from the Colorado River.

All possible effort, with curtailed personnel, is being made in the lanning of the region's 35 projects in the inventory of projects for ostwar construction. Emphasis is being placed on those projects hat can go forward immediately as the Nation converts from war to eace. The potential program, which would require an expenditure of upwards of $1,000,000,000 would supplement and insure the water supply for some 600,000 acres presently irrigated but without an adequate water supply, as well as furnish water for some 800,000 acres of lands not now irrigated. In addition to the irrigation benefits, these multiple-purpose projects would add 1,885,000 kilowatts of hydroelectric capacity to the Region's power pool.

Resumption of work on Davis Dam, halted late in 1942, has been authorized by the War Production Board. This dam, 65 miles downstream from Boulder Dam, will aid in regulating the flow of the Colorado River for downstream uses and provide means of compliance with the pending treaty with Mexico.

Construction work on a large scale can be resumed at short notice on the Gila and All-American Canal projects. These projects when completed and developed will provide for, roughly, 3,000 new family-size farm units. Study of the Central Arizona project, a project to divert water from the Colorado River to the highly developed irrigated agricultural area near Phoenix now sorely in need of supplemental water, is receiving priority attention. The State of Arizona is cooperating in the investigations of this project. Progress on the many other projects in the inventory will be accelerated as additional personnel and equipment become available.

REGION 4

Region 4 increased its contribution to the winning of the war while carrying on limited construction activities and speeding up postwar plans for basin-wide development of water resources. This region includes most of Utah and Nevada, that part of Wyoming and Colorado west of the Continental Divide, and small sections of Idaho, New Mexico, and Arizona.

Food for fighting men and industrial war workers was the major contribution to the war from 18 projects in operation in the region. Such operation included the storage of water in 13 Bureau reservoirs, with an aggregate capacity of nearly 1,365,000 acre-feet, in addition to the distribution and handling of other water supplies for irrigation. Approximately 494,000 acres irrigated by these projects in 1944 produced crops valued at $35,000,000, an increase of over 50,000 acres and $500,000 respectively during the year.

The West's big $200,000,000 steel plant at Geneva, Utah, was furnished an increased industrial water supply from the Provo River project. The city of Ogden, Utah, threatened with a water shortage, continued to receive protection for its municipal supply from Pineview Reservoir, which, also, furnished water to war housing facilities and the Army's Bushnell Hospital in the area. The armed forces benefited from the services of 33 experienced engineers on military leave from the region. Reclamation reservoirs provided recreational opportunities for thousands of people.

Construction continued on the Mancos project, Colorado, and the Newton, Provo River, and Scofield projects, Utah. Sufficient progress had been made on the enlargement of two canals and a section of the Provo River Channel, Provo River project, to furnish a supplemental water supply of 28,000 acres of highly developed lands. A 6-mile pipeline section of the 40-mile Salt Lake Aqueduct was constructed, bringing to completion about 20 miles of the conduit that will carry water to Salt Lake City and other municipalities and industries in the area. Work was advanced on Scofield Dam and highway and railroad relocations. Work was still suspended by War Production Board stop-order on the 6-mile Duchesne Tunnel of the Provo River project, the Eden project, Wyo., and three small reservoirs of the Ogden River project.

In project planning activities, emphasis was placed on the formulation of general basin-wide plans for full utilization and control of water resources in three river basins. Preliminary reports outlining comprehensive plans for ultimate development in the Colorado River and Bonneville Basins were prepared and submitted informally for review and comment to the States and local interests concerned.

The Colorado River report, prepared in cooperation with region 3, outlines some 92 projects in the upper basin to provide 1,200,000 acres of new land with a full irrigation supply and 500,000 acres of inadequately irrigated land with a supplemental supply. Potential hydroelectric power plants are outlined with installed capacities aggregating 1,700,000 kilowatts and annual firm power generation exceeding 9 billion kilowatt-hours.

The Bonneville report describes 13 potential projects, including those that would import water from the Colorado River Basin, to bring a full irrigation supply to 350,000 acres not now irrigated and a supplemental supply to 325,000 acres insufficiently irrigated. In addition 1.2 billion kilowatt-hours of energy could be produced in hydroelectric plants, and flood control and other benefits provided. A report was well advanced on the Lahontan Basin, and detailed project investigations were being conducted and plans and estimates were being prepared for several projects in these three basins which are recommended for initial construction in the postwar period.

REGION 5

Maintenance of a high level of agricultural production on operating projects, continued construction on three war-food projects and planning for a program of postwar development marked the activities of region 5 during the current fiscal year.

The 6,534 irrigated farms in the Carlsbad and Rio Grande projects in New Mexico and Texas produced crops last year valued at $23,205,821. The crops were grown on 174,858 acres, and the cash income averaged $132.10 an acre. Almost 17,000,000 kilowatt-hours of hydroelectric power, with revenue amounting to $329,447.90, were produced last year at Elephant Butte Dam on the Rio Grande project in New Mexico.

Construction in the region during the year was centered principally on the Altus, Oklahoma, and Tucumcari, New Mexico, projects, and to a minor extent on the Balmorhea and Marshall Ford Dam projects in Texas, and the Fort Sumner project in New Mexico.

Altus Dam and a major portion of the reservoir storage system, including relocation work on highways and the main canal from the dam to the project boundary, were completed. Water will be delivered t a part of the project in the fiscal year 1946.

Construction of the Tucumcari project was continued and wate for the first 7,000-acre unit of project lands is scheduled for deliver early in the next fiscal year. Plans were also being made to rus construction of a 64-mile transmission line from Las Cruces to Alamogordo, New Mexico, to supply power for the Alamogordo Arm Air Field and the United States Army's Ordnance proving ground at White Sands.

Comprehensive reports on basin-wide investigations of the Ri Grande, Nueces, Guadalupe, and Colorado Rivers were completed and the tentative drafts submitted to the Commissioner. Investigations in the Red and Arkansas River Basins were approximately 7 percent completed. Reports for the Canton and Middle Rio Grand Valley projects were in final stages of preparation, and surveys wer initiated on the San Juan-Chama diversion. A power market survey in the Alamogordo, New Mexico, area was completed, two land use programs were developed for the projects under construction and a review was made of the land classification surveys for bot projects. Approximately 600 acres were leveled on the Altus projec and several thousand acres were cleared and leveled on the Tucumcar project. A demonstration farm was initiated on the Altus project

The war has affected Bureau operations in many ways. Construction was limited to those projects considered essential unde either the war food or war power program and even on such project was carried on under severe handicaps. The increased cost of labo and materials on the two projects under construction is estimated a nearly $11,000,000. The increased cost of project planning surveys for salaries and wages alone, is estimated in excess of $100,000 Serious losses, though not always tangible, were sustained on cro lands under the drive of all-out production for war. Farmers, i many instances, abandoned normal crop rotation plans in order t meet food goals, increased acreages of soil-depleting crops, wer unable to carry out usual fertilizer programs because of shortages i materials, equipment, and manpower. It is estimated that cro production on the two projects under construction would have increased by $7,000,000 had it not been for the war, and this does no include the value of livestock, poultry, and garden truck that woul have been produced had the projects been completed and made productive. Also, more than a million acre-feet of water has spille over Conchas Dam since December 1941, unused for irrigation becaus construction of the canal system on the Tucumcari project had to b deferred.

With the end of the war, these projects will be fully developed and
any more will be completed as soon as funds, manpower, and
aterials are obtainable. Altogether, there are 53 projects included
the Bureau's inventory for postwar construction in region 5, which
cludes all of Texas and Oklahoma, most of New Mexico, the southern
alf of Kansas and a small area in south-central Colorado. Comple-
on of these projects will make 11,500 irrigated farms available for
ttlement, irrigate 1,269,000 acres of new land, provide additional
ater for 991,000 acres inadequately irrigated, and make available
emendous quantities of low-cost hydroelectric power for agricultural
e and industrial expansion.

REGION 6

National attention was focused during the year on the Great
lains area of the Missouri River Basin as the Bureau of Reclamation
ent forward with plans for undertaking after the war the largest and
ost ambitious development program in the 43-year history of the
gency. The Congress gave its endorsement to that program by
loption of the Flood Control Act of 1944 which approved the co-
dinated plan of the Bureau and the Corps of Engineers, War De-
artment, to put the Missouri and its tributaries to work in expand-
g the agricultural and industrial economy of a region embracing one-
xth the continental area of the United States.

The act authorized 29 projects for construction by the Bureau and
ıthorized an appropriation of $200,000,000 to each of the agencies
r carrying out the initial phases of the program. The Bureau con-
nued its engineering and economic investigations which have been
progress for the past several years and which culminated last year
the presentation to the Congress of a report (S. Doc. 191, 78th
ong., 2d sess.) setting forth a comprehensive program for resource
evelopment in the basin. It is contemplated that this investigation
ork and the preparation of detailed plans and specifications will be
reatly expanded within the next few months with a view to having
veral projects ready for starting construction by the beginning of
e next fiscal year.

To more effectively coordinate its work, the Bureau in September
944 established a regional office at Billings, Montana, for the area
ade up of the States of North and South Dakota, most of Montana,
nd the northern part of Wyoming. This office works closely with
e region 7 office at Denver, which serves the remainder of the area
rained by the Missouri River and its tributaries.

Bureau-operated projects in region 6 continued their record produc-
on of food and fiber crops in helping to meet increased war demands.
total of 342,623 acres were irrigated on the eight operating projects
the region and the crops produced had a gross value of more than

$14,000,000. This is equivalent to more than 30 percent of the total investment which the government has made in the construction of these projects.

Among the major contributions to the food supply of the Nation were 3,346,000 bushels of cereal grains, 239,000 bushels of hay, flax, pea, and vegetable seeds, 165,000 tons of hay, 1,300,000 bushels of beans, potatoes, and other truck, and 355,000 tons of sugar beets. The inventory value of all livestock on the farms of the eight projects at the close of 1944 was $17,200,000.

Under the war food program, 14,400 acres have been brought under irrigation on the Buford-Trenton project near Williston, N. Dak., works have been almost completed for 8,000 acres in the Second Division of the Buffalo Rapids project, near Terry, Mont. Though restricted by War Production Board orders and labor shortages construction work was also in progress on the Deerfield Reservoir near Rapid City, S. Dak., a project to furnish supplemental water for irrigated lands in Rapid Valley and a municipal supply for Rapid City. Civilian Public Service camps were furnishing labor on both the Rapid Valley and Buffalo Rapids No. 2 projects.

A contract for the construction of works to irrigate 800 acres on the Intake project near Savage, Mont., was awarded and bids had been received for the Big Flat project of 900 acres near Missoula, Mont. Advertisements for bids on the 1,600-acre Dodson project, near Malta, Mont., were issued but bids had not been opened at the close of the year.

In the power field three operating plants produced a total of 141,783,000 kilowatt-hours, more than 84,000,000 of which were produced at the Fort Peck plant operated by the Corps of Engineers, and marketed through the Bureau of Reclamation.

A 115,000-kilovolt transmission line to carry energy from Fort Peck to Glendive, Mont., was under construction.

At the end of the year there were 43 regional employees in the office at Billings, Mont., and 367 employees in the field working on planning, operation and maintenance, construction and power operation.

REGION 7

With large-scale construction halted or retarded because of the war, major emphasis of the Bureau in this region was placed on continuing high level production of food and electric power and in laying the groundwork for carrying out coordinated plans for Missouri Basin development and completion of trans-mountain diversion projects. Region 7 was established 3 months after the start of the fiscal year as the newest subdivision in the Bureau's program of decentralization, and includes the State of Nebraska, northern half of Kansas, northeastern Wyoming, and western Colorado.

More than $16,000,000 worth of war-vital crops were produced on the North Platte project (Wyoming-Nebraska), with a full water supply provided for 209,668 acres and a supplemental supply for 96,803 acres. Expanded war industries in the Rocky Mountain area made increased demands for electric power, and four Bureau-operated plants generated 185,000,000 kilowatt-hours of energy, distributed over some 900 miles of transmission lines to industry, cities, and farms.

Construction efforts were concentrated on the Colorado-Big Thompson transmountain water diversion project in northern Colorado and on the Mirage Flats irrigation project in northwestern Nebraska. Work proceeded, despite delays due to manpower and material shortages, on the lining of the 13-mile Alva B. Adams Tunnel beneath the Continental Divide, and on Shadow Mountain Dam near Grand Lake, key features of the Colorado-Big Thompson project.

Completion of the project will provide for the diversion of 310,000 acre-feet of surplus water annually from the western slope of the Rockies, through the Alva B. Adams Tunnel, for supplemental irrigation of 615,000 acres on the eastern slope and the generation of about 600,000,000 kilowatt-hours of electric energy annually. Delivery of 90,000 acre-feet of water annually is scheduled to start in the spring of 1946. Full diversion is expected to increase crop values on the eastern slope by approximately 5 million dollars annually. On the Mirage Flats project in Nebraska, construction of Box Butte Dam on the Niobrara River was about 90 percent complete and work on the irrigation canals and laterals was in an advanced stage. The dam will store water for irrigating 13,000 acres of new land to be opened for settlement by veterans and others.

Investigations were nearly complete on two other major projects proposed for postwar construction in region 7—the Gunnison-Arkansas transmountain diversion project and the Blue River-South Platte project, both in Colorado. With Missouri River waters originating in or flowing through all four states in which it functions, region 7 is also taking an active part in the plans and program for coordinated development of the Missouri Basin.

U. S. RECLAMATION INVESTMENT NEAR BILLION

At the end of the 1945 fiscal year the total investment of the Federal Government in projects constructed by the Bureau of Reclamation amounted to $952,893,542, an increase of $31,122,922 over the previous year.

During its 43 years of operation, accretions to the Reclamation fund have totaled $228,106,850 (see table 4). These have come from the sale of public lands, proceeds from the Oil Leasing Act, from Federal water power licenses, potassium royalties, and rentals and receipts from naval petroleum reserves from 1920 to 1930 unde the act of May 9, 1938. Collections—construction and operation an maintenance repayments, water rentals, power revenues, etc.—hav totaled $173,263,626.

Disbursements during that period have totaled $358,689,871, leaving a balance in the fund on June 30, 1945, of $42,680,606. Repayments of construction charges to the Reclamation fund during th fiscal year 1945 totaled $3,611,000. Operation and maintenanc collections totaled $1,513,000, of which $442,000 accrued to th Reclamation fund. Receipts from water rentals, power sales, an other sources aggregated $9,462,000.

TABLE 4.—Accretions to Reclamation fund by States

States	Sale of public lands		Proceeds from Oil Leasing Act		Total to Ju 30, 1945
	Fiscal year 1945	To June 30, 1945	Fiscal year 1945	To June 30, 1945	
Alabama				$197, 635. 78	$197, 635.
Arizona		$2, 766, 339. 36	$1, 792. 87	9, 294. 47	2, 775, 633.
Arkansas			886. 47	886. 47	886.
California		8, 304, 067. 54	1, 790, 905. 22	24, 986, 829. 16	33, 290, 896.
Colorado [1]		10, 326, 330. 20	207, 288. 14	1, 443, 771. 65	11, 770, 101.
Idaho		7, 058, 097. 58	463. 90	22, 901. 84	7, 080, 999.
Kansas [1]		1, 033, 601. 40	39, 664. 88	50, 667. 94	1, 084, 269.
Louisiana			13, 581. 31	355, 632. 08	355, 632.
Michigan			1, 323. 54	2, 390. 35	2, 390.
Mississippi			122. 06	232. 31	232.
Montana [1]		15, 388, 624. 90	574, 201. 33	2, 362, 562. 24	17, 751, 187.
Nebraska [1]		2, 097, 698. 70	94. 50	446. 25	2, 098, 144.
Nevada		1, 042, 345. 90	9, 627. 46	24, 361. 01	1, 066, 706.
New Mexico		6, 742, 810. 30	943, 189. 49	5, 909, 994. 87	12, 652, 805.
North Dakota [1]		12, 219, 646. 27	25, 445. 46	303, 496. 45	12, 523, 142.
Oklahoma		5, 931, 145. 58	4, 854. 09	13, 181. 16	5, 944, 326.
Oregon		11, 995, 324. 73	894. 46	1, 950. 04	11, 997, 274.
South Dakota [1]		7, 733, 675. 48	5, 277. 20	30, 103. 27	7, 763, 778.
Utah		4, 397, 539. 48	197, 009. 23	1, 491, 678. 72	5, 889, 218.
Washington [1]		7, 475, 102. 22	845. 12	46, 116. 08	7, 521, 218.
Wyoming		8, 722, 080. 55	2, 918, 225. 36	44, 740, 980. 73	53, 463, 061.
Total		113, 234, 430. 19	6, 735, 892. 09	81, 995, 112. 87	195, 229, 543.
Proceeds, Federal water power licenses					[2] 996, 812.
Proceeds, potassium royalties and rentals					[3] 2, 102, 194.
Receipts from naval petroleum reserves, 1920–38, act of May 9, 1938					29, 778, 300.
Grand total		113, 234, 430. 19	6, 735, 892. 09	81, 995, 112. 87	228, 106, 850.

[1] Missouri Basin States.
[2] Proceeds for fiscal year $36,221.99.
[3] Proceeds for fiscal year $424,430.38.

STATUS OF RECLAMATION FUND

Accretions to the fund:	
Sales of public lands	$113, 234, 430. 19
Royalties and rentals under Mineral Leasing Act	81, 995, 112. 87
Federal water power licenses	996, 812. 85
Potassium royalties and rentals	2, 102, 194. 34
Receipts from naval petroleum reserves, 1920–38, act of May 9, 1938	29, 778, 300. 23
Total accretions	228, 106, 850. 48

NEW LAWS ADVANCE RECLAMATION

Legislation of far-reaching significance to Reclamation was enacted y the Congress during the past year. Most important was the assage of the Flood Control Act of 1944 (58 Stat. 887; Pub. Law 534, 8th Cong.) signed by the President December 22. This act:

1. Approved the coordinated plan of the Bureau of Reclamation and the Corps f Engineers, War Department, for development of the Missouri River Basin as et forth in Senate Documents No. 191 and 247, Seventy-eighth Congress, Second ession.
2. Authorized appropriations of $200,000,000 to each of these agencies for artial accomplishment of the works to be undertaken under the general comrehensive plan.
3. Established the principle that "the use, in connection with the operation and naintenance of such works for navigation herein or hereafter authorized for contruction, of waters arising west of the Ninty-seventh meridian shall be subordinate o and shall not adversely affect at any time the beneficial consumptive use, west f the ninety-seventh meridian, of such waters for domestic, irrigation, mining or ndustrial purposes."
4. Provided that the use of irrigation water stored in reservoirs constructed by he Corps of Engineers, War Department, shall be in accordance with Reclamation aws.
5. Provided that electric power produced at dams constructed by the Corps of Engineers shall be marketed by the Secretary of the Interior.
6. Provided for review and recommendations by the States and other Federal gencies concerned, of the reports by the Secretary of the Interior and the Secreary of War proposing and recommending construction of projects under the provisions of the act.

Several of the policies set forth in the Flood Control Act of 1944 were subsequently restated by the Congress in passing the River and Harbor Act of March 2, 1945. (Pub. Law 14, 79th Cong., 1st sess.).

This latter bill failed of enactment by the Seventy-eighth Congress due partly to a controversy which arose over an amendment which would have exempted lands in the Bureau's Central Valley project in California from provisions of the law limiting to 160 acres the area that can be held in single ownership on Federal Reclamation projects. This amendment and other controversial issues were stricken from the bill as reintroduced, and passed, by the Seventy-ninth Congress.

Water and power users on Reclamation projects benefited by the amendment on April 19, 1945, of the Fact Finders' Act (Pub. Law 35, 79th Cong., 1st sess.). The Congress by this amendment provided that the cost of administration of the reclamation program, whether incurred by the Commissioner's office in Washington or by regional or branch offices, should not be assessed against water or power users.

Another law passed to benefit farmers on Federal Reclamation projects is the act of April 24, 1945 (Pub. Law 39, 79th Cong., 1st sess.), amending sections 4, 7, and 17 of the Reclamation Project Act of 1939. This act now extends the time within which amendatory contracts may be negotiated and within which the Secretary of the Interior may grant deferments of construction charges. It also modifies the operation of the normal and percentage plan by putting a ceiling on the amount that can become due in any year through the operation of the plan. Finally, this act now permits minor amendments, without further reference to the Congress in amendatory contracts, which have already been authorized.

The Seventy-ninth Congress also passed an act (Pub. Law 34) consenting to the negotiation by Colorado and Kansas of a compact for the division of the waters of the Arkansas River.

Veteran settlement discussion was focused during this year on a bill (H. R. 520) introduced by Representative John R. Murdock of Arizona. This bill would "facilitate settlement of returning veterans in projects constructed, operated, and maintained by the Bureau of Reclamation." Extensive hearings were held before the House Committee on Irrigation and Reclamation and the bill was reported out by unanimous vote of the Committee with recommendation that it be enacted.

Hearings were also held on Senate bill 555, to establish a Missouri Valley Authority, and the Commissioner and other officials of the Bureau made statements on the bill before the Senate Committee on Commerce.

BUREAU WINS INTERNATIONAL RECOGNITION

The work of the Bureau of Reclamation in developing western resources has won international recognition, and its engineers have been called upon by many foreign governments for technical assistance in the planning and design of projects in other countries.

John Lucian Savage, chief designing engineer for the Bureau, returned to the United States in March from an extended tour of duty in China and the Middle East as engineering consultant to various foreign governments on their plans for postwar irrigation and powe developments. In his 34 years of service with the Bureau, Mr Savage has drawn plans for the construction of more than a billion dollars worth of dams, including the three largest concrete dams eve built—Grand Coulee, Shasta, and Boulder. He went to China a the special request of the Chinese Government, "on loan" from the Bureau to the United States State Department. While there, he made the preliminary surveys and studies for several large reclamation projects, including the huge Yangtze Gorge project for irrigation and flood control. He also spent several months in India. Mr. Savage' engineering achievements have won him many honors and this yea he was awarded the John Fritz medal, one of the highest honors o the engineering profession. He retired as chief designing enginee in May but will continue to serve the Bureau in a consulting capacity

The work of the Bureau has been recognized in many other ways. Another member of its staff, Engineer Douglas McHenry, was awarded the Telford Premium by an engineering group in Great Britain. Design and construction methods used by the Bureau have been made available to many foreign governments through technical papers, by visits of foreign engineers and public officials to Bureau projects and offices and through facilities of the Bureau training program. During the year, 38 engineers from 15 foreign countries visited the design and construction offices and several of the men remained for training. Arrangements were made during the year to train foreign engineers under the sponsorship of the Foreign Economic Administration. Nineteen engineers from China began their training with the Bureau during the summer of 1945.

The Bureau's Concrete Manual has become a recognized text on concrete. Its distribution is world-wide and two foreign countries have translated it. The manual on dams, preparation of which was begun during the fiscal year, will be a comprehensive compilation of data on dam investigation, design, construction, and operation.

DECENTRALIZED ORGANIZATION

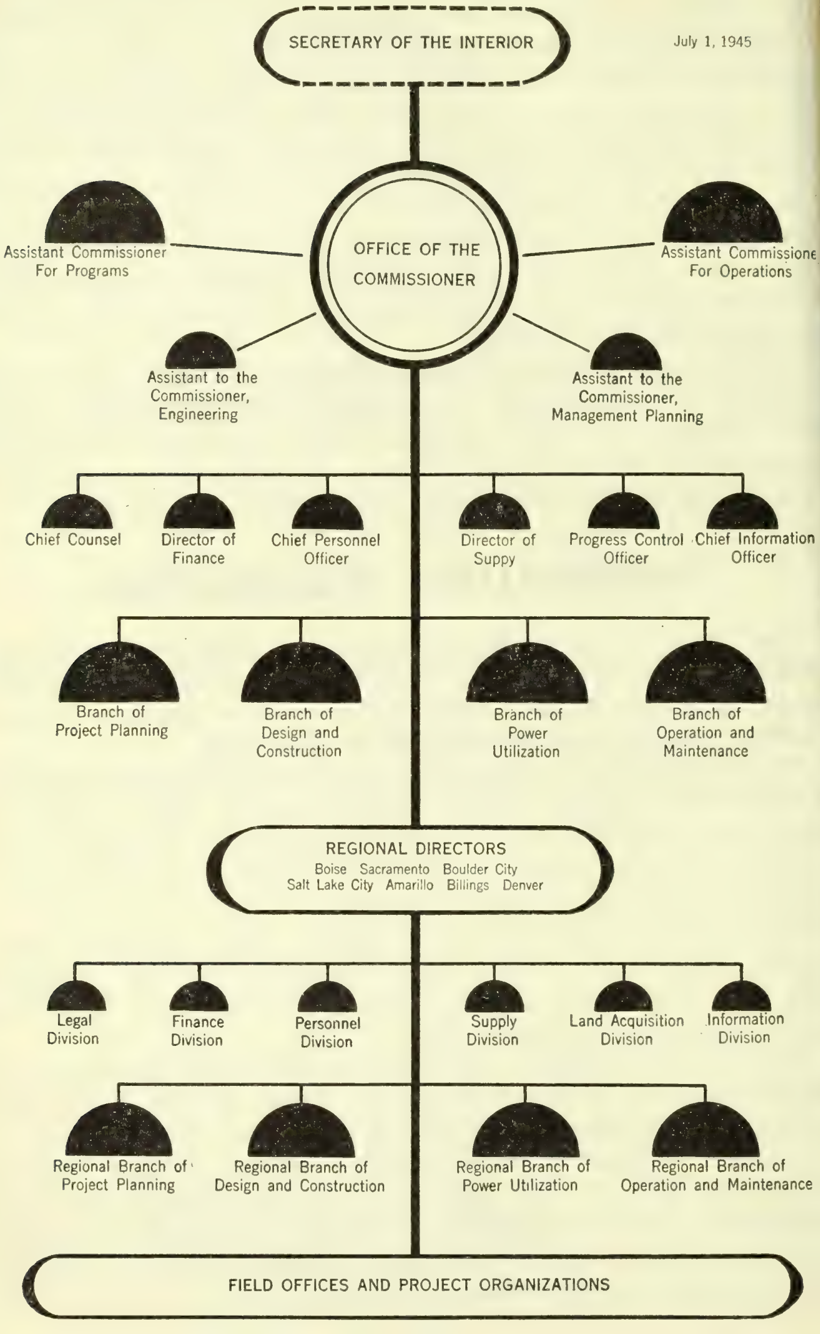
The Bureau of Reclamation, following through on a decentralization plan inaugurated in September 1943, created a seventh regional office during the fiscal year and further developed and strengthened existing staffs to expedite both war and postwar objectives.

The basic concept for streamlining the Bureau has been the establishment of competent regional organizations in each of the seven major watersheds in the 17 Western States with authority to act swiftly and surely in close collaboration with States, local interests, and other affected Government agencies.

The seven regional offices are as follows: Region 1, Boise, Idaho; region 2, Sacramento, Calif.; region 3, Boulder City, Nev.; region 4, Salt Lake City, Utah; region 5, Amarillo, Tex.; region 6, Billings, Mont., and region 7, Denver, Colo.

The regional directors who are responsible for coordinating all Bureau activities within their regions, report directly to the Commissioner of Reclamation. They are assisted in technical phases of their work by four technical branches, namely, Project Planning, Design and Construction, Operation and Maintenance, and Power Utilization, and by administrative facilities in the fields of management, law, finance, public information, supply, personnel, and office services, which are also centrally directed.

BUREAU OF RECLAMATION


July 1, 1945

SECRETARY OF THE INTERIOR
OFFICE OF THE COMMISSIONER
Assistant Commissioner For Programs
Assistant Commissione For Operations
Assistant to the Commissioner, Engineering
Assistant to the Commissioner, Management Planning
Chief Counsel
Director of Finance
Chief Personnel Officer
Director of Suppy
Progress Control Officer
Chief Information Officer
Branch of Project Planning
Branch of Design and Construction
Branch of Power Utilization
Branch of Operation and Maintenance
REGIONAL DIRECTORS
Boise Sacramento Boulder City
Salt Lake City Amarillo Billings Denver
Legal Division
Finance Division
Personnel Division
Supply Division
Land Acquisition Division
Information Division
Regional Branch of Project Planning
Regional Branch of Design and Construction
Regional Branch of Power Utilization
Regional Branch of Operation and Maintenance
FIELD OFFICES AND PROJECT ORGANIZATIONS

The Branch of Operation and Maintenance was transferred from Denver to Washington during the fiscal year. In addition plans were made to transfer the Branch of Project Planning and the central budget function to Washington early in the fiscal year 1946.

The chart indicates the present organizational arrangement of the Bureau under the decentralization plan.

The number of Reclamation employees increased from 6,513 on June 30, 1944, to 7,033 on June 30, 1945. Further increases in the Bureau staff, greatly depleted by the war, will be required to accomplish authorized postwar programs. A total of 1,806 employees of the agency have entered the armed forces of the United States; so far, 30 have given their lives and 4 are missing.

The number of persons employed in the various Bureau activities are: Commissioner's office, 141; Branch office, Denver, 837; region 1, 1,773; region 2, 764; region 3, 1,175; region 4, 302; region 5, 1,009; region 6, 410; and region 7, 622. Ten new project and other field offices, exclusive of headquarters for project planning work, were established during the year.

PERSONNEL CHANGES

The past year has been marked by several changes in the Bureau's top-ranking personnel. Notable among these was the retirement after 34 years of Bureau service of John L. Savage, chief designing engineer, who has won world renown for his work on Grand Coulee, Shasta, Boulder, and many other dams in this country, in addition to serving as an adviser to foreign governments.

Another important change in the Denver office was the appointment of Walker R. Young, assistant chief engineer since 1940, to succeed S. O. Harper, who retired after 37 years in Reclamation. Three assistant chief engineers were appointed as follows: Chief of Civil Engineering Division, W. H. Nalder; Chief of the Electrical and Mechanical Division, L. N. McClellan; and Chief of the Construction Division, Ralph Lowry.

E. B. Debler, Director of the Branch of Project Planning, was appointed Director of the newly created region 7 with headquarters in Denver. John R. Riter, assistant Director of project planning, moved up to the position as Director of that Branch.

Goodrich W. Lineweaver, assistant to the Commissioner, was appointed Director of the reorganized Branch of Operation and Maintenance. Clifford E. Fix replaced J. Kennard Cheadle as Chief Counsel when the latter resigned to enter private practice. Barrow Lyons became Chief Information Officer.

TABLE 5.—Consolidated statement by projects of construction cost of irrigation works, other items reimbursable with construction, and deductions

State and project	Construction cost		Operation and maintenance before public notice (net)		Operation and maintenance deficits, arrearages, and penalties		Construction revenues, contributed funds, and non-reimbursable appropriations (contra)		Abandoned works, non-reimbursable cost and authorized charge-offs	Balance	
	Fiscal year 1945	To June 30, 1945	Fiscal year 1945	To June 30, 1945	Fiscal year 1945	To June 30, 1945	Fiscal year 1945	To June 30, 1945		Fiscal year 1945	To June 30, 1945
Regular projects											
Total	$22,483,044.71	$535,232,327.19	$53,839.64	$3,455,365.53	$149,472.77	$9,223,308.67	$870,613.15	$17,754,302.14	$17,127,127.29	$21,520,858.20	$513,029,571.96
Water conservation and utilization projects											
Total	1,849,512.78	8,515,380.01	[1] 13,912.95	[1] 55,037.49	----	----	[2] 2,627.47	[2] 4,050.82	----	[3] 1,860,797.55	[3] 8,566,366.68
Special projects											
Colorado River Dam fund:											
All-American Canal	261,694.63	32,232,964.24	----	----	----	----	----	----	----	----	----
Boulder Canyon	1,173,810.95	142,387,505.29	----	----	----	----	----	----	----	----	----
Arizona:											
Davis Dam	197,858.11	3,499,855.77	----	----	----	----	----	----	----	----	----
Parker Dam	2,090.29	6,821,853.10	----	----	----	----	----	----	----	----	----
Parker Dam power	417,033.72	15,188,187.35	----	----	----	----	----	----	----	----	----
Montana: Fort Peck	557,746.45	644,749.92	----	----	----	----	----	----	----	----	----
Texas: Colorado River	102,544.22	23,744,940.24	----	----	----	----	----	----	----	----	----
Washington: Columbia Basin	4,081,767.86	184,625,779.03	----	----	----	----	----	----	----	----	----
Total	6,790,365.65	409,145,834.94	----	----	----	----	----	----	----	----	----
Grand total	31,122,922.43	952,893,542.14	----	----	----	----	----	----	----	----	----

[1] Operation and maintenance during construction.

[2] Construction revenues.

[3] Net construction cost.

Division of Power

ARTHUR GOLDSCHMIDT, *Director*

* * *

THE work of the Division of Power, which is charged with supervising and coordinating the power activities of the Department, continued along lines dictated by the marketing problems resulting from war operations, as well as by concern for postwar conversion and expansion.

The responsibilities of the Division have been greatly enlarged by the enactment of the Omnibus Flood Control and Rivers and Harbors Acts which direct the Secretary of the Interior to transmit and market all excess power generated at reservoir projects constructed by the War Department, in such manner as to encourage the most widespread use of the power at the lowest possible rates to consumers consistent with sound business principles, and to give preference in its sale to public bodies and cooperatives. In this legislation the Congress reiterated the public power policy which it has developed during the past 40 years in the Reclamation, the Tennessee Valley Authority, the Rural Electrification, the Bonneville, the Fort Peck, and other acts dealing with power. Fundamentally that policy directs that the benefits of Federal power developments shall not be monopolized by limited groups, but shall be widely distributed so that the power shall develop the industry and agriculture of the Nation, and lighten the burden of the domestic consumer.

The ultimate installed capacity of the authorized flood control projects is more than 5,775,000 kilowatts, and of the authorized rivers and harbors projects is over 1,425,000 kilowatts, or a total of more than 7,200,000 kilowatts.

The Department of the Interior is now operating and marketing power from the largest aggregate of hydroelectric capacity in the world, including power which is generated at dams operated by the United States Army Corps of Engineers.

The total investment in power facilities at projects from which the Department markets the power, including parts of dams and reservoirs allocated to power, aggregated nearly $425,000,000 on June 30, 1944, on the basis of tentative power investment figures for those projects where the allocation studies have not been completed.

This figure also includes the Grand River Dam project which i owned by the Grand River Dam Authority of the State of Oklahom but which since September 1, 1943, has been operated by the Department.

The generating plants from which the Department now market power delivered 18 billion kilowatt-hours of salable energ during the 1945 fiscal year as compared with 17.6 billion kilowatt-hours the preceding fiscal year. In 1940 all of the power plant under the jurisdiction of the Department produced 3,672,995,00 kilowatt-hours. As of June 30, 1945, the total installed capacity o such plants in operation amounts to 3,107,300 kilowatts. Durin the 1945 fiscal year the three major power agencies of the Department, the Bonneville Power Administration, the Bureau of Reclamation, and the Southwestern Power Administration generated 17,820,000,000 kilowatt hours of which 17,300,000,000 kilowatt-hours wer sold for a gross revenue of $45,500,000.

Fortunately, hydroelectric power is not a "nonrecurring" assets To be sure, the billions of kilowatt-hours that have gone t war in the past year are not available for nonwar or for futur peacetime uses. But the power facilities and the river resource through which they were developed are long-run assets for the peopl of the United States to use in their national defense or in the general welfare. Against the 7,300,000,000 kilowatt-hours that were used for war purposes from the Columbia River projects, for instance, must be measured the untold millions of kilowatt-hours that were not developed during the year at proposed projects on that river system that have been authorized or studied. Unused resources, throughout the country, represent "frozen" assets that must be made useful by development. To that end the congressional authorization in the Flood Control and Rivers and Harbors Acts and the comprehensive development program of the Bureau of Reclamation will provide for a realization of a large portion of our unused hydro energy resources. But these vast new power resources must be sold and to accomplish this task efficiently studies by the power selling agencies of the Department are now under way in collaboration with other Federal agencies and with State and municipal organization. The successful efforts to develop and use the tremendous supply of public power for war activities, must, with the coming of VE-day and the anticipation of VJ-day, be matched by achievement of appropriate reconversion programs and load building activities in order to provide for the period of transition from a wartime basis to a peacetime economy without avoidable wastage of this natural resource.

The Division has also been working with the war agencies on the problem of disposition of fuel-operated generating plants that have been built to serve some of our large military establishments and war plants. Acquisition by the Federal power agencies of those plants which will not be needed for defense purposes after the emergency, as a means of supplementing and firming the hydroelectric power which is now generated or will be generated by the proposed Federal plants, has been under study. Such coordination of Government facilities will result in better operations in areas of irregular stream flow, and consequently in sounder financial arrangements, lower rates, and greater regional benefits. In some instances such fuel-operated plants can provide needed peaking or standby power which is now being purchased by the Government.

Regional studies.—The Division has continued its participation in studies being conducted by the agencies of the Department in efforts to work out the pattern for the administration and the extension of the multipurpose developments in the various river basins throughout the country, such as the Sacramento and San Joaquin Rivers, the Columbia River, the Missouri River, the Arkansas River, the Colorado River, and the rivers in the Southeastern section of the United States. These studies are necessary to determine the best method for making available to the people of the various areas the maximum benefits of the multipurpose projects at a minimum cost. These studies include the use of power for war production, the scheduling of construction features, the reconversion of war plants in the areas, the extension of these projects to provide additional postwar opportunities, the allocation of costs, and the power policies to be effectuated.

Rates and rate schedules.—No reductions were made in the various wholesale rates of the Department during the year, but substantial reductions were made by purchasers of low-cost Department power for resale as required under their purchase contracts. Private power companies making such reductions include the Montana-Dakota Utilities Co., serving eastern Montana and western North Dakota, with a reduction of over $200,000 per annum; the Mountain States Power Co., serving northwestern Wyoming, with a reduction of over $25,000 per annum; The Texas Power & Light Co., serving northern and eastern Texas, with a reduction of approximately $400,000 per annum, which includes a 10 percent reduction to Federal war loads; and the Arkansas Power & Light Co., serving much of the State of Arkansas.

Thirty-seven REA-financed projects are being supplied with power at rates ranging down to about 3 mills a kilowatt-hour. Owing to the inability to obtain materials because of war-time restrictions, no increase was made within the year in the number of Rural Electrification Administration financed projects served by the power agencies within the Department.

The Division reviewed during the year several major rate studie including the interim rate for the Central Valley project in Californi and the rate structure of the Bonneville Power Administration in th Pacific Northwest. In connection with the latter study which is sti under consideration are proposed rates for the electrification of th railroads and the generation of steam by the use of secondary electrica energy.

Contracts.—Further efforts to decentralize the administration o power matters, while achieving maximum uniformity, has resulted i the establishment of standard contract provisions for Bureau o Reclamation projects.

Miscellaneous.—The Division participated in the negotiations fo the disposal of the Hetch Hetchy power by the city of San Francisc in accordance with the terms of the Raker Act. The injunctio against the sale of this power to the Pacific Gas & Electric Co. has bee put into effect as a result of arrangements made by the city to use it power for its own municipal purposes and to sell power directly to tw irrigation districts and to industrial war plants in the area.

The Division cooperated in studies and negotiations of the Bureau of Reclamation for the proposed acquisition of power facilities of Salt River Water Users' Association in Arizona and of the Minidoka and Burley power facilities in Idaho in an effort to bring about unified operating systems and to make possible lower rates. The Division also cooperated in the study of the financial feasibility of proposed power projects of the Bureau of Reclamation prior to authorization and in the handling of the power contracts of the Defense Plant Corporation for Boulder Dam power.

The Division was also able to render service to the Puerto Rico Water Resources Authority in connection with its priorities problems in the construction of the Caonillas Dam and transmission facilities which are necessary in the supplying of power to Army and Navy bases in Puerto Rico. Assistance was also given to the Territorial Government of the Virgin Islands in connection with the studies of critically needed AC generating and distributing systems for the towns of Charlotte Amalie, St. Thomas, and Christiansted and Fredericksted, St. Croix.

Bonneville Power Administration

PAUL J. RAVER, ***Administrator***

THE FOURTH WAR YEAR

Y June 30, 1945, the power of the Columbia River, harnessed by the two great Federal projects, Bonneville and Grand Coulee Dams, nd marketed by the Bonneville Power Administration, had played major role in the production of several billion dollars worth of hips, planes, light metals, chemicals, and other war supplies.

During the 3½ years since the United States entered the war on ecember 7, 1941, the Administration has delivered a total of 17.5 illion kilowatt-hours to war industries and military establishments. evenues from the sale of this power for war purposes aggregated 43,216,192 to June 30, 1945.

War loads continued to consume a major share of the Administraion's total power deliveries during the 1945 fiscal year. Of 8.5 illion kilowatt-hours sold during that 12-month period, the Pacific orthwest's five aluminum reduction plants and one aluminum olling mill took 4.6 billion kilowatt-hours. Although minor cut-acks in Northwest aluminum production occurred early in 1944 nd more serious cut-backs threatened, the Nation's continuing high vel of aircraft production made it necessary to revise estimates of luminum requirements, and by the summer of 1945 all of the Northest plants had been requested to increase production to capacity. n fiscal year 1945, as in 1944, the Northwest plants produced more han one-third of the Nation's entire aluminum output. Aluminum roduced with Columbia River power contributed greatly toward he establishment of United States air supremacy in the European nd Pacific battle areas. The 503,144,000 pounds of aluminum roduced by Northwest plants in this 12-month period was sufficient o produce 10,000 B–29s or 150,000 fighter planes.

Of even greater importance to final victory in World War II was he contribution made by Bonneville-Grand Coulee power to the evelopment of the atomic bomb. The location of the Hanford ngineer Works in the Pacific Northwest was determined to a considerable extent by the availability of large quantities of hydroelectric power and water from the Columbia River.

Working closely with representatives of the United States Army and the Hanford project, engineers of the Bonneville Power Administration conducted studies to determine: (*a*) The most reliable location on the Bonneville Power Administration system for the important Hanford load, (*b*) what system circuits and connections would be necessary so that the Bonneville generators could pick up and carry this load in case of trouble at the Coulee powerhouse, (*c*) how the remainder of the Bonneville system could be disconnected from the Hanford load to permit the Bonneville powerhouse or the Coulee powerhouse generators to continue carrying the Hanford load in case of major disturbances on the Bonneville system.

As a result of these studies, the Bonneville Power Administration was able to provide large quantities of power to the Hanford project with the highest possible degree of reliability, a prime requisite to successful production of the atomic bomb.

Other war materials produced during the past year in plants using Bonneville-Grand Coulee power included 181 ships—54 Victory cargo ships, 62 troopships, 63 tankers and 2 aircraft carriers—and large quantities of calcium carbide, ferroalloys, chemicals and explosives.

While the Bonneville Power Administration continued its home front job of delivering power for war, 1,050 employees on military furlough with the nation's armed forces were scattered over fighting fronts throughout the world.

CURRENT OPERATIONS

Kilowatt-hour sales of the Bonneville Power Administration for fiscal year 1945 totaled 8,502,000,000 compared with 8,671,000,000 the preceding year. Despite the slight drop in kilowatt-hours, revenues increased 10 percent from $20,896,000 to $22,990,000 after deduction of a $438,560 reserve for contract and bill adjustments. This situation arises from the fact that the revenues are power billings which are based upon capacity contracted for, rather than upon energy delivered as regards the bulk of the Administration's service. For the period from the commencement of operation to June 30, 1945, earnings from power sales have aggregated $63,626,000.

INDUSTRIAL AND RESOURCES DEVELOPMENT

As World War II drew to a close in 1945, the Bonneville Power Administration began to focus attention more sharply on the problem of developing peacetime power markets to utilize surplus power becoming available as Pacific Northwest war plants curtailed operations or closed.

Analysis of the Administration's war loads indicates that a maximum of 600,000 kilowatts, or approximately 50 percent of our total capacity may become available for remarketing.

Confronted with this possibility, the Administration is devoting considerable effort to the formulation of an extensive program of market and system development designed to provide markets for surplus power as quickly as possible, and to assist in retaining the Pacific Northwest's wartime industrial gains. The marketing program is directed toward the development of new power markets in industries that will directly or indirectly provide jobs for returning service men and displaced war workers.

REPORTS

As a part of this program, the Division of Industrial and Resources Development completed a number of reports during fiscal year 1945, based on continuing studies of Pacific Northwest resources and potential power markets.

A particularly valuable report issued during fiscal 1945 was one entitled "A Preliminary Report on the Plastics Industry as Related to Pacific Northwest Industry." This report originally had been prepared for limited distribution to technical and industrial interests. The response from industry, however, was so overwhelming that a new printing was ordered.

A new supplemental report on the same subject is now in course of preparation. It deals in specific terms with cellulose-base plastics, for the manufacture of which a great potential exists in the Pacific Northwest.

Economic surveys under the general title "Economic Base for Power Markets" were issued for the following counties: Clatsop County, Oreg., and Cowlitz, Walla Walla, and Thurston Counties in Washington. Similar surveys which were under preparation during the year and are scheduled for early release include Lane, Lincoln, and Benton Counties in Oregon; Flathead, Lake, and Sanders Counties in Montana. In Washington State, studies were under way for Chelan, Douglas, Okanogan, Clallam-Jefferson, Franklin, Benton, Skagit, Mason, Grays Harbor, Stevens, Ferry, and Pend Oreille Counties.

Reports for use within the Administration included one entitled "A Preliminary Study of Railroad Electrification in the Pacific Northwest." In brief, this study revealed the following points:

(1) In a region of great hydroelectric abundance, it seems undesirable from the standpoint of national interest to allow a continuously replaceable form of energy to remain unused while remaining irreplaceable reserves of petroleum and coal are further depleted.

(2) The development and utilization of railroad motive power is at a critical juncture, with newer forms of prime movers rapidly appear-

ing to claim the place long occupied by the old familiar reciprocati steam locomotive.

(3) The Diesel-electric locomotive, which thus far has been a gives promise of continuing to be the most likely replacement for t steam locomotive, is not a completely satisfactory answer. Neith phsyically nor economically does the Diesel solve all the proble which are posed by the retirement of the steam locomotive. So f as yard switching service goes, the Diesel is granted to have prove its case, and not even the most ardent advocates of electrificatio suggest any deviation from the trend toward their full replacement steam units in yard and industrial trackage assignments.

(4) For main-line purposes, the problems are entirely differen Here a strong case, and it is believed an ultimately compelling on can be made for the straight-electric locomotive.

(5) Physically, the straight-electric locomotive compares favorabl with the Diesel-electric. Actually, they are both electric locomotives so far as the method by which torque is supplied to drivin wheels is concerned. Where they differ is that one is supplied wit electricity generated on the locomotive by a severely limited mechanism of prime mover, generator, etc., which must also carry its ow fuel supply as dead weight and which has no overload capacity whatsoever, while the other can be supplied from a trolley system with th almost limitless capacity of hydroelectric central stations.

The Bonneville Power Administration, realizing that there was relatively little likelihood of adding to electrified trackage during th war, has directed its inquiries toward an appraisal of the postwa possibilities. Action has been sought on a power rate schedule tha would be conducive to the consideration of electrification, and some thought has been given to the best and most economically feasible method of bringing service from the Administration's facilities to the railroad's trolley systems. This has involved some attention to the problem of standardization of railway electrification systems which have in the past involved too many variations to lend themselves either to the most economic manufacture or operation. Studies will be continued particularly on these two subjects during the ensuing year.

Numerous other technical reports were prepared, including one on the effects of new industrial developments on tax revenues in the Pacific Northwest, and one entitled "A Review Study of the Columbia Basin" for the use of the Bureau of Reclamation. A third report dealt with shipments through the locks of Bonneville Dam. An exhaustive report was also made on the zinc lead mines of the Pacific Northwest and tributary areas.

INDUSTRIAL CONTACT ACTIVITIES

In carrying out the Bonneville Power Administration's industrial research and development programs, contacts have been made with leading industrialists and businessmen throughout the country.

Through these contacts valuable information on the Northwest's resources and market potentialities has been made available to industries in all sections of the country, many of which are looking to the Pacific coast as the last industrial frontier.

Bonneville's industrial contact program has been directed to a large extent toward the fields of electronics, electro-process industries and other industries in which low-cost power is an important element.

The region's tremendous hydroelectric power resources coupled with its rich forest, agricultural and mineral resources furnish a sound basis for the belief that the Pacific Northwest corner of the United States will play an important role in the development of new electronic, chemical, and metallurgical industries based on important discoveries made in these fields during the war.

Specific products which Bonneville research indicates can be produced in the Northwest include: phosphorus, manganese bronze, glass containers and glass blocks, sulfuric acid, industrial alcohol, electrolytic iron and other powdered metals, electrolytic zinc, rayon, pigments, dichromate salts for ink, electrolytic manganese, fertilizers, chlorine and acetylene products, tars and phenols, coal and byproducts, limestone, plastic metals, lithium and other rare metals, ferro-alloys, silica sands, battery lead, and litharge.

All of these products have been discussed with industrial representatives, and it is expected that a number of new Northwest plants will be constructed in the near future as a result of these contacts.

Bonneville's industrial contact activities have been instrumental in initiating action on a number of plants already under construction or completed, including the Springfield alcohol plant near Eugene, Oreg., the alcohol plant at Bellingham, Wash., in which use is made of sulfide liquor wastes from the pulp mill in that locality. In the promotion of both of these ventures, the Bonneville Power Administration played a pioneering part.

Development of the Salem, Oreg., alumina plant was encouraged and its promotion maintained by the Bonneville Power Administration in cooperation with regional interests. Of particular interest are the electric boilers in the plant, an innovation for which Bonneville Power Administration had primary responsibility.

In electrolytic iron, the Administration stimulated the interest of three major companies, one of which is now proceeding with the selection of sites and expects to begin plant construction in the near future. The Administration is continuing its activities in the field of powdered metallurgy now gaining in practical importance, particularly in the automotive industry. The Bonneville Power Administration also continued to stimulate interest in electrolytic manganese.

The availability of titanium-bearing sands caused the Administration actively to stimulate research in the utilization of the titanium fractions for the use of pigments. Much interest is developing in the industrial potentialities of this resource.

An important plant for the manufacture of resinous plastics for the plywood industry has been established by one of the key companies in this field. Continuous contact and release of the "Preliminary Report on the Plastics Industry" by the Administration had a direct bearing on the establishment of this plant.

Activity and interest in the production of rare metals such as lithium have been followed closely by the Administration and continuous contact with one of the major producers of rare metals indicates the possible establishment of a large plant in this region.

Culminating 8 years of effort on the part of the Administration in the utilization of electric power for the manufacture of glass was the establishment of a sizable glass-producing unit in a Northwest glass plant utilizing the so-called Cornelius electric glass furnace. The success of the operation will bear definitely on the use of this type of furnace elsewhere in the Pacific Northwest in the coming expansion of glass-producing industries.

Also as part of the interest in chemical industries, renewed activity has taken place in the mining of limestone and silicas. These two materials are the basis for any chemical industries which might develop in the Pacific Northwest.

INDUSTRIAL STUDIES

The industrial contact work indicated above requires careful advance as well as continuing industrial and market analysis. In this respect, studies on limestone and silica and on lead and zinc were prosecuted by members of the staff, together with a multitude of short-run studies required for direct industrial contacts.

The Administration continued with collaborative studies on a wood-utilization experimental pilot plant for the production of charcoal. It also collaborated in basic research work on the utilization of titanium-bearing sands for the production of pigments.

In order to lay a sound basis for market analysis, the Administration began a long-range study of interregional and intraregional freight rates as well as of specific markets for specific power-using industries. Utilization of local coals for the production of charcoal, phenol, and tars was the subject of much contact work. Discussions with leaders of industry and with Government officials on a comprehensive study of fertilizer use and potential production in the Pacific Northwest have also been carried on in the past fiscal year. Also initiated was a long-range study of railroad electrification, with numerous collaborating contacts with the TVA, Bureau of Reclamation, and various railroads and manufacturers of equipment.

An attempt to stimulate interest in the manufacture of line hardware by local manufacturing enterprise was launched during the year, with interesting initial results.

A long-range program in the use of aluminum and its fabrication in the Pacific Northwest was initiated by the staff. The cooperative relationship of the Administration with the Office of Alien Property Custodian was continued, with many direct contacts made by the Alien Property Custodian representative.

COOPERATION WITH OTHER AGENCIES

Staff members prepared testimony and participated in hearings before the United States Senate Special Committee to Study and Survey Problems of Small Business. Particular emphasis was given to problems relating to the disposal of Government facilities in the production of aluminum and in general problems of business and industrial expansion in the Pacific Northwest States. Another committee with which the Administration collaborated was the United States Senate Committee on Centralization of Industry. Numerous conferences were held with State officials on matters relating to industrial and resource development and initial conferences were held in the four Pacific Northwest States with staff members of higher educational institutions for the purpose of developing cooperative programs of research in industry and resource utilization.

THE LIGHT METALS INDUSTRY

Much effort was put forth by the Bonneville Power Administration during the fiscal year 1945 in studying problems of industrial and peacetime operation of Government-owned light metal plants in the Pacific Northwest. Declaring it to be a primary objective of the Bonneville Power Administration to assist in the utilization of Northwest resources for the development of a well-rounded industrial economy to provide maximum employment, Administrator Paul J. Raver, in testifying before the Murray Small Business Committee, maintained that the aluminum industry can and should be a major part of that development. The following recommendations to be undertaken immediately by Government agencies to assist new operators to take over the Government-owned aluminum plants and operate them successfully were made at that time. In substance, they are:

1. In order to prevent immediate shutdown of the major part of the aluminum capacity because of a shortage of war orders, minimum

markets above immediate normal needs should be provided b Government stock-piling of aluminum ingot as a national defens measure.

2. The Government should control all surpluses of virgin and so called secondary metal, releasing them gradually so as not to interfer with an orderly change of price levels.

3. Government should provide new operators with access to higl grade, imported bauxite to insure an adequate and reliable source o raw material.

4. Government agencies should coordinate and increase efforts i the direction of assisting private enterprise to appraise both expor and domestic use of light metals. The question of freight rates i basic to the aluminum marketing problem, and the Bonneville Powe Administration has started studies of freight rates on electro-industr products.

5. In order to help overcome problems of improper location, fractional capacity operation and reopening of shut-down plants, the Government should provide engineering assistance in appraising production costs, grant flexible terms of lease and assume the costs of plant alterations and, where necessary, finance relocation of improperly located plants or their equipment. So far as power rates are involved in this problem, the Bonneville Power Administration has pointed out its obligation to pay for the cost of the power projects out of revenues as provided by Congress in the Bonneville Act.

UTILIZATION ACTIVITIES

Intensive efforts have been devoted throughout the year to investigation and study of electric house-heating systems, particularly installations in service for a season or more. It is immediately apparent from public interest shown in this method of home heating that a large potential market for power exists in this field. As a result of the findings of the Administration's utilization engineers in the field, many of the adverse attitudes heretofore caused by lack of knowledge of energy demands and of the cost of the electric space heating, have been dissipated.

These investigations have included extensive measurements and tests on existing heating installations to determine results and costs of this type of heating. Although a great deal of data have been accumulated, much work remains to be done in this field, particularly because of continuing new developments in electric heating methods.

In the fields of rural and agricultural utilization, considerable investigation has been made into improved methods of hay drying, fruit dehydration, sprinkler irrigation, scientific dairying, and food preservation by means of electric processes.

COOPERATIVE RESEARCH PROJECTS

As a part of the program for developing use of power in the Pacific orthwest, particularly for farm use and electric house heating, a rogram of cooperative research with colleges and universities in the orthwest was initiated by the Administration during fiscal year 1945.

Funds utilized for this research program were those provided by the ongress for advanced marketing activities. Agreements were xecuted during the fiscal year with Oregon State College, Washington tate College, Montana State College, the University of Washington, nd Linfield College. With each, a basic memorandum of understandig has been executed outlining the relationships between the instiution and the Bonneville Power Administration and forming the asis for specific agreements regarding individual research projects.

With Oregon State College, under a basic memorandum dated ay 22, 1945, eight separate studies are to be undertaken. These will nclude studies on (1) pipe and pipe materials for use with sprinkler rigation, (2) dairy water heating, (3) home built farm refrigeration nits, (4) electric radiant panel heating, (5) reversed cycle heating) electric heat storage and its economic aspects, (7) biochemical nalysis dealing with preservation of forage crops, and (8) livestock eding experiments in connection with cured hay.

Five studies will be made by Washington State College under a asic memorandum dated June 12, 1945. These will include studies n (1) cranberry drying equipment, (2) refrigeration for family use,) corrosion characteristics of metal pipe used in sprinkler irrigation stallations, (4) low-pressure sprinkler investigation, and (5) use of ectric welders on the farm and their effect on rural lines.

Under a basic memorandum dated June 23, 1945, the University of ashington will pursue the following studies: (1) Possible improveents or changes in a design of distribution systems resulting in a wer cost of distribution, (2) domestic house-heating installations in nd near the city of Seattle, and (3) economics of the heat-pump ethod for domestic heating.

Montana State College, under a basic memorandum dated June 11, 45, will make a survey of opportunities for small irrigation pumping ants in western Montana.

Linfield College at McMinnville, Oreg., under a basic memorandum ated June 13, 1945, will prepare a critical survey of the present art water treatment by ozone and other technological uses of ozone.

The total maximum obligation for all of the studies to be underken will amount to $63,528.

Work was started on certain of these projects during the month of ne, and in other projects initial activities will not be undertaken ntil late in 1945. The period for completion will generally extend into late 1946 or early 1947 although in a few instances completion by June 30, 1946, was planned.

Approximately $20,000 has been obligated for studies relative to electric heating. Oregon State College, which has an excellent heating research laboratory, is undertaking to make experimental studies in radiant panel heating, heat storage systems and reversed cycle heating, all with electric energy as the heating medium. Radiant panel heating is perhaps the newest form of heating developed and promises to have considerable future development both because of the inherent advantages of this type of heat and because it appears to be peculiarly well adapted to conversion of existing dwellings from fuel heat to electric heat. Many problems in application of radiant panels are yet unsolved, in part relating to the characteristics of panels of different types, the method of application of panels, and the relative efficiency of panel heating.

Electric heat-storage systems have been in existence for many years and were designed originally in order to control the time of occurrence of the electrical heating load so as to prevent this from coinciding with other loads. With the development of electric heating which will probably occur, it is not likely that this "off-peak" feature will have much practical advantage, but heat-storage systems will enable the maintenance of a constant demand at all times on the electrical system to supply fluctuating heating demands. This characteristic is of great value to electrical distributors. It is hoped by the experiments at Oregon State College that it will be possible to determine the most efficient of the various types of heat storage systems now available and to simplify the designs so as to reduce the cost of installation which now is fairly heavy.

The characteristics of reversed cycle heating or the heat pump are now fairly well known, but application of this method of heating under actual operating conditions, as would be experienced in the climate of this area, are relatively unknown. Experimentation at Oregon State College will uncover the operating problems which are likely to occur and will make possible determination of the technical feasibility of this method of heating. Since the heat pump returns approximately three times as much energy in heat as is required in electricity for operation, a low-cost and practical development of this equipment would enable very rapid expansion of the electric-heating market. The University of Washington's studies in the economics of the heat pump will provide the answer to the present questions of using the equipment under conditions as they exist in the area and will also point the way to determining what reductions in costs or changes in technique are necessary to make the heat pump a practical instrument of heating.

The University of Washington will study the characteristics of xisting heating installations in the Seattle area, which include a onsiderable variety in heating methods, such as radiant panel, heat orage, and radiant-convection. Analysis of the load characteristics nd operating results will help to answer questions which occur in the inds of power distributors and ultimate consumers.

One of the major problems connected with electrical heating is the evelopment of economical methods of distributing electricity to erve the large loads which are imposed by this use. The University f Washington will analyze the problem of the most efficient distri-ution methods for this type of load and the results of their studies ill help in solving many problems involved.

Sprinkler irrigation is a subject of great interest to farmers in he Northwest and to the Bonneville Power Administration as a arketer of power. This method of irrigation holds many advantages or the farmers and also uses large quantities of power. Three esearch projects are planned to study various phases of sprinkler rigation. Washington State College will study the corrosion haracteristics of various types of metal pipe used in sprinkler-rigation installations in order to determine relative durability of arious types and the soil and water conditions to which each is est adapted. This college will also analyze various other problems nvolved in sprinkler-irrigation systems such as the soil and crop onditions necessary, types of sprinkler heads and other problems. regon State College will study pipes and pipe materials for use with prinkler irrigation under conditions in the State of Oregon to deter-ine which types are best adapted for furthering the efficient use f sprinkler irrigation.

Montana State College will analyze the opportunities for establish-ent of small irrigation-pumping units in western Montana. The etailed survey of the area which is planned will reveal the possibilities f developing irrigation projects and the conditions which must be vercome to obtain this development.

Use of electricity on the farm for operation of refrigerating units or preservation of meats, vegetables, and other farm produce promises o be a very large market for electricity in the future. It is of the tmost importance that farm refrigeration equipment be developed hich will perform the job efficiently and will be relatively low in cost. Both Oregon State and Washington State Colleges have been interested n the development of farm refrigerators for many years, and each is onducting a research project on this subject with funds made available y the Bonneville Power Administration.

The interest of farmers has been much attracted in the past few ears by the possibilities of improving the quantity of usable hay arvested by the use of electrically operated blowers for drying hay in the hay mow. This practice is of particular importance in areas where there is considerable rain during hay harvesting periods. One angle which has not been sufficiently investigated to obtain reliable data is that of the nutritional qualities of barn-dried hay. It has been claimed that these are superior but this claim was not based on very thorough scientific research. Accordingly, Oregon State College proposes to expand its research program in hay drying to include investigations of the biochemical analysis of barn-dried hay in comparison with ordinary hay. They will also conduct livestock feeding experiments to throw light on the nutritional quality of barn-cured hay.

Washington State College will conduct a study of the use of electric welders on the farm which will indicate the operational characteristics of this equipment and the improvements which should be made to better adapt it to the needs of the farmers and to meet the limitations of electric power lines. This college will also conduct experiments in the development of electrically powered cranberry dryers which will make possible more efficient practices in the harvesting and marketing of cranberries.

POWER SALES

During fiscal year 1945 approximately 86 percent of all energy generated at the Bonneville-Grand Coulee plants was delivered either directly to war industries and military establishments or to other utilities to enable them to serve such loads. The proportion of total deliveries going to war loads is beginning a downward trend from the 90 percent for the 1942–43 fiscal year and 89 percent for the 1943–44 fiscal year.

The Bonneville Power Administration delivered 8½ billion kilowatt-hours of electric energy to 80 customers during this last year. Of this total, 824 million went to publicly owned utilities, 2,057 million to privately owned utilities and 5,632 million to industries and military establishments. As compared with the previous year, deliveries to other utilities increased 13 percent for publicly owned utilities and 40 percent for privately owned utilities; deliveries to industries and military establishments decreased 13 percent. The total of all deliveries under power and exchange agreements decreased 1.8 percent from the comparable figure of the year before.

Noncoincidental maximum demands under power contracts for publicly and privately owned utilities are shown in detail by customers in the accompanying table. Energy deliveries and dates of initial service are also shown by customers.

ABLE 1.—Contracts with customers not served by the Bonneville Power Administration as of June 30, 1945

	Contract demand	Date of execution
ublic or peoples' utility districts:	*Kilowatts*	
Central Lincoln PUD	(1)	Feb. 25, 1942
Columbia River PUD	(1)	Dec. 18, 1942
Nehalem Basin PUD	(1)	July 9, 1942
Northern Wasco County PUD	4,000	Oct. 28, 1940
Okanogan County PUD [2]	2,500	Nov. 8, 1944
Stevens County PUD	(1)	Oct. 8, 1943
Tillamook County PUD	2,000	May 15, 1940
Union County PUD	(1)	Mar. 2, 1942
Whatcom County PUD No. 1	16,500	May 15, 1942
ooperatives:		
Blachly-Lane County Cooperative	50	Oct. 7, 1941
Coos Electric Cooperative	(1)	Feb. 29, 1944
rigation districts: Vera irrigation district	500	Apr. 4, 1944
ndustries: DPC—Salem Alumina [2]	(1)	June 30, 1945

[1] No contract demand specified.

[2] Executed in fiscal year 1945.

ABLE 2.—Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1945

Customers	Noncoincidental maximum demand during year	Energy deliveries for year	Date of initial service
eliveries under power contracts:			
Public agencies:			
Municipalities:	*Kilowatts*	*Kilowatts*	
Canby, Oreg	435	1,725,000	Feb. 1940
Cascade Locks, Oreg	366	1,438,800	Mar. 1939
Centralia, Wash	300	60,000	Jan. 1941
Drain, Oreg	220	724,000	Apr. 1941
Ellensburg, Wash	2,502	4,046,400	May 1941
Forest Grove, Oreg	1,440	5,907,200	Dec. 1939
Grand Coulee, Wash.:			
Grand Coulee	600	2,352,600	Jan. 1942
Delano	140	484,800	Oct. 1942
McMinnville, Oreg	3,660	16,127,000	Oct. 1940
Monmouth, Oreg	388	1,638,400	Dec. 1940
Total municipalities	10,051	34,504,200	
Public utility districts:			
Clark County PUD:			
Air reduction	1,260	7,582,000	Aug. 1942
Dormitory	1,300	7,085,000	Sept. 1942
Mill plain	13,752	64,242,000	Aug. 1942
Clatskanie PUD	--------	396,720	Mar. 1943
Cowlitz County PUD	15,673	109,790,825	Aug. 1941
Grant County PUD:			
Soap Lake	282	1,262,000	Aug. 1942
Coulee City	120	520,717	Do.
Grays Harbor County PUD	12,400	55,554,000	Nov. 1940
Kittitas County PUD	210	810,600	June 1941
Klickitat County PUD	186	633,030	Nov. 1940
Lewis County PUD	690	2,501,400	May 1941
Pacific County PUD:			
Raymond	2,450	10,396,465	Oct. 1940
Naselle	1,269	5,394,600	Nov. 1940
Skamania County PUD:			
Stevenson	588	2,451,600	Jan. 1940
White Salmon	436	1,043,280	Apr. 1942
Bonneville Dam	25	14,300	Jan. 1943
Wahkiakum County PUD:			
Cathlamet	678	2,762,666	Nov. 1940
Svenson	134	558,049	Do.
Total PUDs	51,453	272,999,252	

TABLE 2.—Energy deliveries to customers of the Bonneville Power Administration, fis year ending June 30, 1945—Continued

Customers	Noncoincidental maximum demand during year	Energy deliveries for year	Date initia servic
Deliveries under power contracts--Continued			
Cooperatives:	*Kilowatts*	*Kilowatts*	
Benton-Lincoln Electric Cooperative	651	2,566,800	Oct. 1
Benton Rural Electric Association:			
Prosser	366	1,563,600	July 1
Grand View	390	1,526,400	Do.
Big Bend Electric Cooperative	508	1,816,630	Aug. 1
Clearwater Valley Light & Power	960	3,894,200	Do.
Columbia County REA	414	1,812,900	July 1
Douglas Electric Cooperative:			
Oakland	533	2,056,694	Do.
Brockway Junction	172	595,600	Sept. 1
Idaho County Light & Power Cooperative	205	735,600	Aug. 1
Inland Empire REA:			
Colfax	1,290	5,361,200	Do.
Opportunity	1,060	4,291,900	Do.
Kootenai County REA:			
Coeur d'Alene	525	1,951,800	Do.
Harrison Flats	38	110,110	Do.
Lincoln Electric Cooperative:			
Davenport	343	1,222,470	Apr. 1
Almira	389	1,561,824	Do.
Nehalem Valley Electric Cooperative	86	288,120	Feb. 1
Nespelem Valley Electric Cooperative	216	788,400	Sept. 1
Northern Idaho RERA	370	1,246,608	May 1
Okanogan County REA	144	559,920	Aug. 1
Pend Oreille Electric Cooperative	207	636,228	May 19
Salem Electric	768	3,117,120	Mar. 19
Stevens County Electric Cooperative:			
Addy	235	862,920	Aug. 19
Evans	392	1,439,180	Do.
Umatilla Electric Cooperative:			
Substation	433	1,784,166	July 19
Depot	816	3,866,826	Feb. 19
Wasco Electric Cooperative	204	776,700	May 19
Total cooperatives	11,715	46,433,916	
Total public agencies	73,219	353,937,368	
Privately owned utilities:			
Mountain States Power Co	1,200	2,403,000	Aug. 19
Pacific Power & Light Co	2,475	20,215,538	June 19
Portland General Electric Co	185,000	982,621,000	Dec. 19
Puget Sound Power & Light Co	164,000	657,830,000	Oct. 19
Washington-Pacific-Northwestern	135,000	296,280,000	
Total private utilities	487,675	1,959,349,538	
Military establishments, 14	38,379	162,652,802	
Industries, 18	833,907	5,469,451,566	
Total under power contracts	1,433,180	7,945,391,274	
Deliveries under exchange agreements:			
Publicly owned:			
Centralia		128,000	
Eugene		6,135,000	
Seattle		148,959,000	
Tacoma		314,658,000	
Total		469,880,000	
Privately owned:			
Pacific Power & Light		23,568,462	
Washington-Pacific systems		74,285,433	
Total		97,853,895	
Total exchange		567,733,895	
Total of energy sales under power contracts and exchange		8,513,125,169	

PUBLIC DISTRIBUTION

At the end of the fiscal year the Bonneville Power Administration d signed contracts with 54 publicly owned utilities and cooperatives. uring the fiscal year, a contract with one publicly owned utility d been canceled and another had been added, leaving at the end the fiscal year the same number of contracts with publicly owned tilities as were in existence at the end of the previous fiscal year. Of the 54, all but 12 of the publicly owned utilities are now taking ower, either under power or exchange contracts. Deliveries to the 2 publicly owned utilities for the fiscal year amounted to 823,817,368 lowatt-hours, an increase of 13 percent over the previous fiscal ear. During this fiscal year, 504,384,200 kilowatt-hours were devered to municipalities which is an increase of 6 percent over e previous fiscal year. The deliveries to public utility districts mounted to 272,999,252 kilowatt-hours and is an increase of 27 pernt over the previous year. The cooperatives received 46,433,916 ilowatt-hours of energy, an increase of 23 percent over the previous ear.

The noncoincidental maximum demand during the year for these ublicly owned utilities was 73,219 kilowatts.

The public agencies distributed low-priced Bonneville power under e best American business tradition of delivering it at the lowest ossible cost to the ultimate consumers.

For the calendar year 1944, the 38 publicly owned distributors—mitting Centralia, Eugene, Seattle and Tacoma—received a gross come of $4,802,889; and after deducting the cost of power, other perating expenses, depreciation, taxes and interest, had a net income f $761,044. The net income amounts to approximately 16 percent f the gross revenue and included in the deductions from the revenue re taxes amounting to $203,374.

These 38 public agencies had cash on hand or invested in United tates bonds amounting to $3,024,777, which exceeds slightly the ccumulated surplus of $3,013,845. The cash on hand of $3,024,777 14½ percent of the total long-term debts of these distributors. The ash on hand also amounts to 63 percent of the gross annual revenue. his financial showing by the public distributors leaves no doubt as o the financial soundness of these distributors and the ability to istribute power to the ultimate consumers at the lowest possible cost.

Data for the cities of Centralia, Eugene, Seattle, and Tacoma have een omitted from this tabulation for they have distributed power for any years; Tacoma—for more than 50 years. These are wellstablished and they received during the past fiscal year only a small art of their energy requirements from the Administration.

SYSTEM POWER RESOURCES

No new generators were added to the system during the fisca year ending June 1945; however, the generating capacity was sufficient so that by careful scheduling of outages, each of the 1 main units at the Bonneville and Grand Coulee plants could b shut down for annual overhaul and maintenance.

Although the total load on the Bonneville-Grand Coulee system wa slightly less than that of the previous year due to cutbacks in wa production, increased deliveries to the utilities of the Northwest powe pool largely offset the decrease in industrial load.

With stream flows in the Northwest below normal during the summe and fall of 1944, the Administration delivered large blocks of power t other utilities in the region to enable them to meet their load requirements without burning critical fuel oil for power production. By the last week in December, all storage reservoirs west of the Cascade Mountains had been pulled down to their rule curves, or below, and schedules for power from the Administration and other pool utilities were suddenly increased to an all time high. As a result of these high deliveries to the pool, the Bonneville-Coulee system established a record 60-minute peak generation of 1,427,000 kilowatts on January 4, 1945. During the hour of this peak, 623,000 kilowatts were delivered to pool members for their own use. Moderate weather and heavy rains beginning the second week in January and continuing intermittently throughout the winter and spring, relieved the Northwest water shortage and consequently decreased Bonneville Power Administration deliveries to other pool members.

The flow of the Columbia River was below average practically all year, and was below the minimum on record for part of the time. Nevertheless, the power resources of the Bonneville Power Administration were adequate to meet all demands for energy.

During 1945, as in 1944, the Bonneville and Grand Coulee power plants supplied approximately 50 percent of all electric energy consumed in the five Northwest States of Washington, Oregon, Idaho, Montana, and Utah. The task of scheduling loads and regulating the frequency of the entire power pool was carried by the Administration throughout the year, with the actual regulation being done at either the Bonneville or Grand Coulee power plants, depending mainly on water conditions.

The following tabulation of energy receipts and deliveries shows the Administration's major contribution to the Northwest power pool during the past fiscal year. Deliveries to other utilities for their own use increased from 1,810,602,507 kilowatt-hours in fiscal year 1944, to 2,401,859,000 kilowatt-hours or 32.65 percent.

TABLE 3.—Bonneville-Grand Coulee generation (kilowatt-hours)

	Fiscal year 1944	Fiscal year 1945
Bonneville plant	3,488,873,992	3,391,127,400
Grand Coulee plant	5,750,949,460	5,660,446,000
Total	9,239,823,452	9,051,573,400

Power pool operations—scheduled exchange (kilowatt-hours)

Agency [1]	Scheduled to BPA	Scheduled from BPA	
		For own use	Other
Puget Sound Power & Light Co	5,152,000	657,830,000	25,857,000
Tacoma City Light	189,619,000	314,658,000	203,032,000
Seattle City Light		148,959,000	
Washington-Pacific-Northwestern systems		297,791,000	191,685,000
Portland General Electric Co		982,621,000	16,901,000
Total	194,771,000	2,401,859,000	437,475,000

[1] The other members of the Northwest power pool—power systems in Utah, Montana, and Idaho—are not directly interconnected with the Bonneville-Grand Coulee system.

In order to meet the power requirements of other Northwest utilities, several new points of interconnection were established during the year. The first, a temporary tie with the Portland General Electric Co., made at Bonneville's St. Johns substation on July 9, 1944, to relieve overload conditions, was discontinued on November 15 when the company's two underwater cables across the Willamette River were ripped out by a ship's anchor. Failure of these cables resulted in serious curtailment of power to a part of the company's system, but fortunately it was possible to bring into service on the same day a new interconnection with the company, tapping the Administration's St. Johns-Oregon City lines near the Linnton district of Portland.

To further increase deliveries of the Administration's power into the Portland area, one Bonneville generator was isolated to feed power directly into the Northwestern Electric Co.'s system through a temporary interconnection with the Bonneville-Alcoa No. 6 line. This tie was still in service at the end of the fiscal year, pending installation of a permanent interconnection at the Troutdale substation.

A cable failure on the Puget Sound Power & Light Co.'s system between Richmond Beach and President Point occurred on October 25, 1944, and in order to supplement the reduced capacity of the remaining cables and to assure an adequate supply of power on the Olympic peninsula, it was necessary to close the Bonneville Power Administration-Tacoma-Puget Sound Power & Light Co. loop at Bremerton. Except for normal operating outages, this loop has been closed continually since that date.

During the year, stream flow gages were installed on the Columb River at Trinidad, Umatilla, and Celilo; and on the Snake River a Clarkston and Five Mile Rapids. These gages consist of impuls transmitters and telephone connections to the dispatcher's offic enabling the load dispatchers to obtain immediate water flow dat from the various points and to make maximum use of the availab water.

CONSTRUCTION PROGRESS

Although shortage of materials, lack of adequate manpower, change in design and other factors brought about by war conditions hand capped construction progress during the year, the major project under construction were held close to original schedules.

The most important construction project of the year—the Covington-Grand Coulee Line No. 2—was completed on October 6, 1944 approximately 1 month ahead of schedule. Energization of this lin eliminated a serious transmission bottleneck in the Seattle area an reduced the load on the Grand Coulee-Covington Line No. 1 to norma or below. Prior to completion of the second line, Line No. 1 ha been carrying up to 251,000 kilowatts, an overload of 41,000 kilowatts to meet power requirements in the Puget Sound area.

The major construction projects started during the fiscal year wer the Columbia substation, a new 230,000-volt substation near Roc Island on the Columbia River, and a 51-mile 230,000-volt steel towe line from Midway substation to the new Columbia substation Completion of the Midway-Columbia project will improve stability of the Bonneville-Grand Coulee System and increase the amount o energy that can be transmitted to the Puget Sound and Portlan areas.

A total of 149.8 circuit miles of transmission lines of all types wa built during the past fiscal year. Segregated by voltage classifications, this construction included 146.6 circuit miles of 230-kilovol line, 11.9 circuit miles of 115-kilovolt line. and 1.3 circuit miles o low-voltage line.

Six permanent transformer banks, one single-phase transforme and four cooling fan installations, totaling 181,600 kilovolt-amperes and two spare transformers totaling 25,000 kilovolt-amperes wer installed at various substations. However, only 132,100 kilovolt-amperes was energized and placed in service. The remaining unenergized transformers, totaling 49,500 kilovolt-amperes are available for service to the customers when required. Three permanent transformer banks and one single-phase transformer totaling 38,712 kilovolt-amperes were removed from service, leaving a net increase of 142,888 kilovolt-amperes of transformer capacity installed and ready for service during the 1945 fiscal year.

The following tabulation shows, by comparison with fiscal year 944, system additions placed in service during fiscal year 1945:

TABLE 4.—System additions

	Circuit miles			Total
	230 kilovolts	115 kilovolts	Under 115 kilovolts	
ransmission lines:				
Placed in operation during 1945 fiscal year	183.0	25.2	2.3	210.5
In operation on June 30, 1944	1,055.0	1,102.5	361.0	2,518.5
Leased to other utilities			−10.6	−10.6
Transferred to substation plant account		−.2	−.2	−.4
Operated for U. S. Army-Hanford-Taunton		8.5		8.5
Total circuit miles in operation on June 30, 1945	1,238.0	1,136.0	352.5	2,726.5

	Installed at end of fiscal year 1944	Fiscal year 1945		Installed at end of fiscal year 1945
		Added	Removed	
ubstation facilities:				
Transformation (kilovolt-amperes)	2,207,079	[1] 181,600	38,712	[1] 2,349,967
Static condensers (kilovolt-amperes)	31,390	27,720		59,110
Synchronous condensers (kilovolt-amperes)	252,500			252,500
Substations (number)	45	1	3	43
Switching stations (number)	10	1	0	11

[1] Includes 49,500 kilovolt-amperes ready for service but not energized.

THE YEAR'S HIGHLIGHTS

LABOR-MANAGEMENT AGREEMENT

Of particular significance in the year's operations was the signing n May 2, 1945, of a labor-management agreement providing for a nethod of collective bargaining with hourly employees of the Bonneille Power Administration in the trades and crafts unions. This asic agreement was made applicable to all Bonneville hourly emloyees in the trades and crafts who are not subject to the Classificaion Act of 1923.

By the terms of the agreement, conference and consultative machinry and procedures, through the processes of collective bargaining, vere set up (1) to provide for joint determination of fair and reasonable ates of pay, hours and working conditions; (2) to insure the making of ppointments and promotions on a merit basis; (3) to promote stability of employment and to establish satisfactory tenure; (4) to provide or improvement and betterment programs designed to aid the mployees in achieving their acknowledged and recognized objectives; (5) to promote the highest degree of efficiency and responsibility in the erformance of the work and the accomplishment of the public purposes of the Bonneville Power Administration; (6) to adjust promptly ll disputes, whether related to matters covered by the agreement or therwise; (7) to promote systematic labor-management cooperation between the Administration and its employees; and (8) to aid the reestablishment in civilian life of returning veterans.

COLUMBIA BASIN COST ALLOCATION REPORT

An earlier event of signal importance to smooth peacetime conversion in the Northwest was the completion and approval by the Secretary of the Interior on January 31, 1945, of the Columbia Basin Project Cost Allocation Report which was prepared jointly by the Bonneville Power Administration and the Bureau of Reclamation. The report was transmitted to Congress on May 8, 1945, and published as House Document No. 172.

According to the report, total estimated cost for the completed Grand Coulee project is $487,030,228. This includes the total ultimate development of power generating capacity of 1,800,000 kilowatts of power and the completion of irrigation canals and facilities for the irrigation of 1,029,000 acres of arid land in central Washington. The project will provide a livelihood for about a quarter of a million additional people on farms or in industry and service in the project area and for many others in industry and service elsewhere in the Pacific Northwest.

Repayments from power revenues will include $348,065,228, or 70 percent of the total project cost, from commercial power sales by the Bonneville Power Administration and $50,500,000 for pumping power supplied by the Bureau of Reclamation to irrigate the project.

Of the remaining investment, farmers who irrigate the 1,029,000 acres of new agricultural land in the project will repay $87,465,000, or an average capital cost of $85 per acre for their water.

Under the terms of the report, the Federal Government will be repaid all its reimbursable investment in the Columbia Basin project within 75 years, and during that period the project will be maintained out of power revenues so that it will be in excellent operating condition after the capital cost is repaid.

The report states that existing rates of the Bonneville Power Administration are expected to produce revenues sufficient to return the power investment with interest, and to repay all irrigation and other reimbursable costs of the projects which cannot be repaid otherwise, as well as meeting all estimated obligations in connection with the Bonneville-Grand Coulee transmission system.

Commercial power revenues also will be used to establish a special treasury fund amounting to $70,786,815 over the repayment period. This money will be available for possible reduction in water and power rates at Grand Coulee, or for assistance to other irrigation and power projects in the Columbia River Basin.

BONNEVILLE DAM PROJECT COST ALLOCATION REPORT

On June 26, 1945, the Federal Power Commission entered an order making a final allocation of the capital costs of the Bonneville Dam project incurred to June 30, 1944, including interest during construction at the rate of 2.5 percent per annum. The order fixed the total cost at $83,709,430, of which $5,784,055 was incurred for facilities solely for improvement of navigation; $37,681,648 for facilities solely for development of power; and $40,243,726 for facilities having joint value for the production of electric energy and other purposes.

The Commission allocated to power $20,121,800, or 50 percent of the investment in joint purpose facilities. This sum plus the direct power facilities of $37,681,648 makes a total power investment at Bonneville Dam of $57,803,448 as of June 30, 1944.

Supplemental allocations will be made by the Federal Power Commission to include costs incurred subsequent to June 30, 1944, in completing the Bonneville project.

With actual plant investment and operating cost data now available for both the Grand Coulee and Bonneville projects, the Bonneville Power Administration is having an independent commercial audit made covering cost accounts of the Administration and the two generating projects. Upon completion of the audit a comprehensive financial report will be prepared covering the operations and financial status of the entire Federal power development on the Columbia River.

BONNEVILLE REGIONAL ADVISORY COUNCIL

Contributions of great value to the development of the Administration's programs were made by the Bonneville Regional Advisory Council during fiscal 1945. Representative leaders in business, industry, agriculture, education, government, and the press have served either as active members or invited guests at the various meetings of the Council in conferring with the Administrator on matters of moment concerning regional policies and the Bonneville developmental program.

Of particular interest in the activities of the Council was the adoption of a report prepared by an independent committee regarding the question of a coordinated river development program.

Other matters of importance studied and reported upon at Council meetings throughout the year included rural electrification, relation of freight rates to industrial development, electric house heating, power rates for industry and for irrigation, the Administration's advanced marketing program, the transmission construction program and problems involved in developing a coordinated research program for the region.

Southwestern Power Administration

DOUGLAS G. WRIGHT, *Administrator*

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THE Southwestern Power Administration was created by order of the Secretary of the Interior on August 31, 1943, for the purpose of ulfilling the requirements of the Executive Orders 9366 and 9373 which provide for unified administrative control during the war of (*a*) he operation of the Grand River Dam project and the marketing f the power generated by the project, (*b*) the marketing of power enerated by the Norfork Dam project, operated by the United States army Engineers, and (*c*) the marketing of the power generated by he Denison Dam project, also operated by the United States Army Engineers. The Southwestern Power Administration assumed these uties on September 1, 1943, with the present Administrator ppointed as Acting Administrator.

The Flood Control Act of December 1944 vested in the Secretary f the Interior the responsibility for distributing and marketing the power output of the multiple-purpose reservoir projects authorized by the Congress for construction by the War Department. The Southwestern Power Administration has made a general study covering ll of the constructed, authorized, and proposed War Department projects on the Arkansas, White, Ouachita, Red, Brazos, Neches, and Guadalupe Rivers.

PRESENT ACTIVITIES

GRAND RIVER DAM PROJECT

The Grand River Dam project was constructed by the Grand River Dam Authority, an agency of the State of Oklahoma, under a Public Works Administration loan and grant agreement. Construction was started in 1938 and the plant began commercial operation May 1, 1941. Of the total $25,113,636 estimated cost of the project, $11,113,636 was supplied by the Federal Government as a grant and $14,000,000 as a loan which is to be repaid by the Grand River Dam Authority from revenues of the project. The initial installation was four 15,000 kilowatt generating units. Space was provided in the power plant for two additional identical units. The fifth unit was purchased in 1941 by the Grand River Dam Authority, but priorit ratings were not high enough to enable the manufacturers to proceed Late in 1944, adequate priority assistance was granted, and installation of the unit will be completed by the end of 1945. The plan capacity will then be 75,000 kilowatts.

With the power supply for war production becoming critical in 1941 the President on November 21 assumed control of the project on behal of the United States under section 16 of the Federal Power Act an designated the Administrator of the Federal Works Agency to operat the project and dispose of the power generated.

Contracts were negotiated for the sale of power to war industries Forty-thousand kilowatts of the capacity were committed to th Ark-La Electric Cooperative, Inc., for transmission to the Defens Plant Corporation's aluminum plant at Jones Mills, Ark. Othe war loads served are Camp Gruber near Muskogee, Okla.; the Oklahoma Ordnance Works near Pryor, Okla., and the Cardox Corporation at Claremore, Okla.

On September 1, 1943, control of the project was transferred to the Secretary of the Interior. With the end of the war approaching, negotiations have been started to return the control of the project to the State of Oklahoma.

During the period of Federal control, from November 21, 1941, through June 30, 1945, the gross revenue has been $5,499,110.

NORFORK DAM PROJECT

On July 30, 1943, the President under Executive Order 9366 assigned to the Secretary of the Interior the responsibility of marketing the power and energy generated at the Norfork Dam project in Arkansas, which is a combined flood control and hydroelectric development on the North Fork of the White River. This project was constructed and is operated by the United States Army Engineer Corps. The project was built with an initial installation of one 35,000 kilowatt generating unit and provision for three additional units. The cost of the Norfork Dam project is approximately $26,000,000.

The project was operated on an emergency basis while it was under construction to meet a critical power shortage in the Southwest during the last 6 months of 1944 and until March 6, 1945, when commercial operation was begun with a full reservoir. Revenues from the sale of power amounted to $321,593 through June 30, 1945.

DENISON DAM PROJECT

The Denison Dam project was built and is operated by the United States Engineer Corps. It is located on the main stem of the Red

River between Texas and Oklahoma near Denison, Tex., and Durant, Okla.

The Denison Dam project, like the Norfork Dam project, is a combined hydroelectric and flood control development. The cost of the project is approximately $54,000,000. The initial installation consists of one 35,000 kilowatt generating unit, and provision for four additional units.

The project was operated on an emergency basis, like Norfork, during the last 6 months of 1944 and until March 9, 1945, when commercial operation began. Revenues from the sale of power amounted to $313,892 through June 30, 1945.

MARKETING POLICIES

The Grand River Dam project has its own transmission sys m which enables it to serve its customers directly and without relying on the facilities of others. Interchange agreements with the Public Service Co. of Oklahoma and the Oklahoma Gas & Electric Co. provide stand-by and off-peak steam-generated power and energy. Project sales for the fiscal year ended June 30, 1945, were 453,180,939 kilowatt-hours. During the war nearly all of the power has been delivered to war industries. A program of encouraging peacetime industries to locate in the area served by the project has been forwarded for 2 years, with the result that service to The B. F. Goodrich Co. at Miami, Okla., began in December 1944, and construction is under way to bring Grand River Dam power to the lead and zinc fields of northeastern Oklahoma. Introduction of low-cost power into the field will result in prolonging its life for probably 20 years, in the opinion of the major companies which operate in the area.

The Norfork Dam and Denison Dam projects, on the other hand, do not have adequate transmission systems; it has, therefore, been necessary to sell the entire output of the projects to the neighboring private utility companies, Arkansas Power & Light Co., Texas Power & Light Co., and Oklahoma Gas & Electric Co., for the duration of the war. The contracts provide for a reduction in rates to power users of $400,000 per year by the Texas Power & Light Co., and $150,000 per year by the Arkansas Power & Light Co., with the additional provision that rates to the rural cooperatives served by the two companies shall not exceed 6 mills per kilowatt-hour for the duration of the agreement.

Under the 1944 Flood Control Act, the Secretary of the Interior is assigned the duty of marketing the power and energy generated at all dams built and operated by the War Department to Federal agencies, public bodies and cooperatives, and private companies in that order of preference, and is authorized to construct or acquire the necessary transmission lines and related facilities. Accordingly, plans are now being made to interconnect the projects and car out the directive of the act.

COORDINATED OPERATION

Coordination of operations between the three projects has bee impossible during the war because the Government does not own th necessary interconnecting transmission lines, and some of the privat companies, whose lines do not interconnect the projects, have bee unwilling to make agreements for the interchange of power and mutu use of facilities. The Flood Control Act of 1944 enables the Secretar to accomplish the desired coordination by interconnecting the project Engineering studies show that by coordinated operation of the eigh presently constructed or authorized projects in this area, the combine dependable output can be increased by 10 percent both in power an energy over the sum of their individual capabilities.

POSTWAR PLANS

The Flood Control Act of 1944 has made it necessary for the Southwestern Power Administration to plan an extensive program of transmission line construction for interconnecting hydroelectric project in the Southwest and marketing their output. The conclusions an recommendations are included in a report to the Secretary entitle "Report on Comprehensive Plan of Power Distribution and Sale from Hydroelectric Projects as Authorized by the Flood Control Act, December 1944 (H. R. 4485) in the Southwestern Region—Arkansas, Oklahoma, Texas, Louisiana, southeastern Kansas, southern Missouri." It will be necessary to secure an average revenue of approximately 5 mills per kilowatt-hour for the wholesale power and energy delivered to consumers from the integrated system. The conclusions of the report are as follows:

1. The hydroelectric developments at the reservoir projects, under control of the War Department, must be fully integrated with each other, with existing utility system, and sufficient fuel burning generation to firm up their entire capacity to realize the full benefits of the power installations.

2. Adequate transmission and distribution facilities must be made available either by utilizing existing facilities or the construction of new facilities to bring the power from the interconnected hydroelectric developments to the load centers of the area, and to prospective users of the electric service if the most widespread use of the electric power and energy at the lowest possible rates to consumers is to be secured.

Bureau of Mines

R. R. SAYERS, *Director*

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FOREWORD

THE prodigious effort of the mineral industries of the Nation to provide the raw materials for the weapons and munitions of war was supported throughout the fiscal year by the manifold activities of the Bureau of Mines. As the demand for mineral commodities of all kinds increased, the Bureau intensified its work of exploring mineral deposits and developing methods of treating ores, its investigations of fuel resources, its production of helium, its research on explosives, and its many other varied technologic and economic services to the extractive industries.

To help meet the needs for minerals from domestic sources, the Bureau conducted 150 exploratory projects and examined 850 additional ore deposits in 36 States and Alaska. The critical and essential minerals, such as tungsten, vanadium, chromium, zircon, coking coal, fluorspar, mica, asbestos, optical calcite, and crystalline quartz, received special attention. Lead and zinc deposits were explored in a dozen States. Copper deposits were likewise extensively explored, and two major low-grade deposits were confirmed by Bureau engineers in Arizona. A low-grade mercury deposit in California, estimated to contain 10,000 flasks, was disclosed by diamond drilling. Exploratory projects on pegmatites in 6 States stimulated production of strategic mica. Through continuation of the large-scale exploration of bauxite deposits in Arkansas and Alabama, approximately 90,000,000 tons of bauxite of all grades were added to the known reserves. The search for needed nonmetallic minerals was conducted in 12 widely scattered States. In the course of hundreds of such projects, new useful techniques were developed for diamond drilling, bulldozer trenching, and geophysical exploration.

In connection with the Bureau's investigations of mining methods, a method of tamping blast holes was devised which has lowered dynamite consumption 25 percent at mines adopting it, and a new microseismic method of determining rock pressure was further developed.

At its metallurgical experiment stations, demonstration plants, and pilot plants, the Bureau of Mines developed and improved metho and processes for using mineral resources unsuited to ordinary trea ments. Substantial progress toward this end was made with mang nese from extensive low-grade reserves, and full-scale tests at ste plants assured an adequate market for an electrolytic mangane plant large enough to produce low-cost metal. Advances were ma in processes for treating Montana chromite, Idaho cobalt, Alaban iron, South Carolina sillimanite, North Carolina feldspar, and tl domestic and foreign fluorspar stock-piled by Metals Reserve Compan Numerous iron, copper, lead, and zinc ores were tested by ore-dressi methods, and experimental studies were continued on smelting iro chromium-nickel ores of Oregon and Washington, leaching Wyomi vanadiferous phosphate shales, producing titanium and zirconiu metals, reducing magnesium, and extracting alumina from low-gra bauxites, clays, and alunite.

Three ferro-alloy pilot plants, an electrolytic chromium pilot plan and a bauxite mill were completed, and "breaking-in" operatio progressed at a methane-reduction zinc pilot plant.

With fuel shortages still prevalent, the Bureau of Mines acted consultant to industry, Government, and home owners on problen of efficient storage, selection, and utilization of coal and coal product Fuel-efficiency and equipment-acceptance tests, together with national fuel-conservation program, saved thousands of tons of coa Anticorrosion studies and a feed-water-conditioning service helpe protect 300 million dollars worth of boilers and lines at Federal an other plants. New sources of coal were explored in critical-shortag areas, and thousands of samples of coal, coke, peat, briquets, pitc tar, coal dust, and organic compounds were analyzed. To aid anthra cite producers, the Bureau studied mine-flood prevention, suggeste methods for more efficient mining, and developed new uses for surplu anthracite fines. Completion and successful testing of a large gasifi cation retort brought cheap, abundant lignite nearer integrate industrial usage.

Wartime demands having cut sharply into known petroleum re serves, the Bureau stressed research on methods of recovering mor oil from old fields and increasing the use of crudes held undesirabl by refiners because of their sulfur content. With the major effor centered on condensate fields which produce petroleum suitable fo blending or "building" special aviation fuels, seven reports wer published on stimulative production methods. The results of thes and other studies were submitted to operating companies and Govern ment agencies concerned with meeting the war needs for specia lubricants, fuels, and chemicals.

Looking still farther ahead to the day when auxiliary sources o oil and gasoline may be needed to fuel the motorized economy, th

Bureau was well on its way toward the development of synthetic liquid fuels. With Congressional authorization, construction started on a laboratory at Bruceton, Pa., for research on the hydrogenation and gas synthesis processes of producing oil from coal, on a laboratory at Laramie, Wyo., to develop oil-shale distillation processes, and on a demonstration plant at Rifle, Colo., to provide for private industry a technical and economic prospectus on the possibilities of exploiting the country's rich and immense oil-shale reserves. The Bureau engineers went abroad to obtain first-hand information on synthetic fuel operations at plants captured from the Germans. An oil-shale mine was opened in Colorado.

Production at the Bureau's five helium plants, which extract the world's supply of this useful lightweight, nonflammable gas from natural gas, continued at approximately the same rate, for commercial demand increased sharply as direct war uses declined. Helium in Federal gas fields was conserved by increasing the proportion obtained from privately produced natural gas that is being piped to commercial markets, and reserves were augmented by injecting the surplus from this source into the subterranean vaults of the Government-owned Cliffside field for storage until needed. Bureau engineers developed another new use for helium, employing it to trace the underground movements of oil and gas.

To aid industry in conserving irreplaceable equipment and experienced manpower, the Bureau intensified its safety and security programs. Accidents declined and output mounted as the coal-mining industry, demonstrating an increasing acceptance of the recommendations of the Federal inspectors, made innumerable safety improvements in the 3,400 coal mines visited during the year. Bureau engineers and safety instructors trained thousands of additional workers and officials in first-aid, mine rescue, and accident-prevention procedures. They assisted at major mine disasters and investigated mine accidents, explosions, and fires. Mine equipment and materials were tested for safety in the Bureau's laboratories, where special investigations on safe equipment design also were continued for the Navy.

Attesting to the whole-hearted cooperation of the mineral industries in the Bureau's wartime plant-security assignments, the record still was free of a single known case of sabotage when the mineral-production security program was terminated and the explosives control program was curtailed at the close of the fiscal year.

Thousands of chemical analyses and control tests were made on explosives and flammable gases, many for other Government agencies, and cooperative inspections were conducted with the Army, Navy, and State agencies on the storage of explosives. New explosives for mining and military use, and explosive devices captured from the enemy were examined; and research was continued on the ignition of gases and dusts by explosives. New schedules were prepared governing the use of higher charges of unsheathed explosives and the testing of Diesel mine locomotives for use in the gas- and dust-laden atmospheres of coal mines. A method for determining detonator efficiency was developed, and an electronic chronoscope which measures time intervals of a millionth of a second was invented and used in Bureau and military tests on explosives.

To guide Bureau engineers and mine inspectors in preparing gas- and dust-control recommendations, some 19,000 mine-air and coal-dust samples were analyzed for explosion hazards. Advances were made in methods for determining atmospheric contaminants, and many respirators were tested for efficiency.

As the chief source of economic and statistical information on minerals, the Bureau provided the basic facts on domestic and foreign production, stocks, distribution, and consumption required by war agencies and industries to guide their programs. Toward the end of the year, these fact-finding and economic services were being revised to enable industry to meet many reconversion problems and to permit Government to determine policies in regard to potential utilization of surplus war plants, appraisal of postwar employment prospects in the mineral industries, and the use of mineral resources in proposed river-valley development projects. Facts on the causes and frequency of accidents in the mineral industries, also collected and analyzed by the Bureau, proved their worth in helping to keep accident rates within bounds under difficult war conditions.

Demands from industry, war agencies, and the public for published information continued to increase, and the Bureau prepared and issued many bulletins, technical papers, handbooks, and other reports. A large number of other reports necessarily had to be issued on a confidential basis. However, under a rigid policy of economy, the number of copies printed and distributed was held to a minimum. The shortage of paper and difficulties of printing made it necessary to delay the publication for general use of other reports. It is hoped that the accumulation of all the valuable wartime information can be published and made available during the forthcoming year to service the minerals industries and the general public in the reconversion period.

FUTURE WORK

War experience has indicated that the Nation's known reserves of many minerals are inadequate to meet peak emergency demands. This fact emphasizes the need for advance preparation to strengthen the country's domestic mineral position for any future crises. There is wide agreement that such preparation should include some provision r national stock piles of strategic and critical materials, together ith an exhaustive mineral exploration and metallurgical research rogram. Surplus war materials would provide the nucleus for a tock-piling program, and their storage would prevent a deflation of ineral prices that would be inevitable if they were dumped on the arket.

A comprehensive inventory of the Nation's mineral resources is eeded urgently. No accurate, or even reasonably correct, estimate f the location, extent, quality, and minability of the various ores in he United States and Alaska now exists. Neither are the ways and eans of utilizing them fully known. Had this knowledge been available when the war began, it would have saved time, money, and ossibly lives. With the passage of the Strategic Minerals Act in 939, the Bureau of Mines was permitted to make a modest start on a ineral inventory but only a start. When the "day of infamy" ccurred at Pearl Harbor, the objective necessarily was shifted to that f finding deposits that could be brought into production immediately. ime was of the essence and there was none to spare for the usual ecided lag between exploration and production. Exasperating deays occurred, nevertheless, particularly where methods of mining and reating marginal deposits had not been tried out in advance, for prouction does not follow in all cases merely because high prices are ffered for the contained metal in such deposits.

A continuing program is proposed, therefore, which will include oth exploration of reserves and investigation of mining and treating methods so that marginal deposits of strategic minerals can be an effective bulwark against any future emergency. Changing projected needs for a national emergency and continually advancing technical knowledge require a long-term program subject to constant revision so that plans for the development and treatment of large strategic reserves will be the best available and ready for use at once should the need arise. The Bureau is capable and willing to undertake such an assignment.

If the mining and metallurgical processes for low-grade and complex ores were developed and made available, some marginal deposits would come into economic production before another national emergency would be likely to occur, thus contributing to the well-being of industry and the national defense. Small operators interested in such deposits require help, particularly because they are unable to retain research staffs and operate laboratories and pilot plants as large corporations do. Not only technical assistance is required, but economic advice as well, encompassing marketing studies and analyses. The Bureau will continue to render such services to the best of its ability.

The mineral industry has acquired many other problems as a result of the war. In the race against time to provide minerals for war, much of the usual long-range development work has been deferred i existing mines. Some aid may also be required on such problems a acquiring new machinery or replacing old machinery, improvin roads, and obtaining financial backing and skilled manpower. Th Bureau will continue to assist as much as possible in accordance wit the functions that have been delegated to it.

The national security and the national economy are closely linke in all fields, but particularly so in the mineral industry. If the Natio is to be in any sense secure, it must have a healthy, thriving minera industry.

To insure the survival and maintenance of such a going industry consideration must be given to its problems. Victory will abruptl wipe out the Government's war procurement programs for mineral and metals and reduce the premium prices that had been paid fo some of these products. Reconversion of war plants, modernization and repairs for railroads and other heavy industries, and long-deferre demands for consumer goods undoubtedly will take up part o the slack for several years, but domestic producers will require a permanent market and a stable price structure. Lest these be imperiled, careful consideration of the problems of international trad and the disposal of war stocks of metals and scrap will be necessary. The extractive industries must be assured of a helpful and stable national mineral policy if they are to prosper.

SUMMARY OF ACTIVITIES

EXPLORATION AND METALLURGICAL RESEARCH

As the decisive campaigns of the war opened and the demand for raw materials necessary to the manufacture of arms and munitions increased, engineers of the Bureau of Mines intensified their quest for adequate sources of metals, and metallurgists redoubled their research on methods for utilizing the vast reserves of low-grade mineral deposits. Substantial progress was made in each field.

During the fiscal year 1945, the engineers examined 850 mineral deposits and conducted exploratory projects on 150 deposits in 36 States and Alaska. Meanwhile, the metallurgists solved problems of immediate importance in supplying critically needed materials for war together with some of longer-range significance.

To the engineer in the field and the metallurgist in the laboratory, the approach differed but the objective was the same—more effective utilization of the mineral resources to the end that they might make the greatest possible contribution to the Nation's economy and security.

Criteria for Projects

In selecting deposits for exploration, restrictions upon the Bureau quired that one of the following criteria apply in each case:

1. Geologic, geophysical, or engineering evidence must indicate, in e judgment of the Bureau's engineers, that the project has a possi- lity of making a substantial contribution to the national economy; or

2. The project must show promise of making a direct contribution to e national security, such as the possibility of producing material for Government stock pile; or

3. The project must have been specifically authorized and directed the Congress.

Following exploration, samples from the mineral deposit were sub- itted to the Bureau's laboratories and pilot plants to determine hether the material could be treated commercially by known meth- ls. If not—and this frequently is true now that the "cream-skim- ing" period of mineral exploitation has reached its denouement in e United States—new processes of treatment were sought. In this anner some low-grade mineral deposits become actual ore reserves.

In the course of conducting hundreds of exploratory projects, the ureau of Mines developed several useful new exploratory techniques. a northern iron district, glacial drift as much as 90 feet in thickness erlies important deposits of magnetite iron ore. Because of numer- us boulders in this unconsolidated material, it was difficult to drill rough to solid rock. A new technique was developed on the spot by e engineers. The method was to freeze the moisture in the gravel, order to hold the boulders firm so that they could be drilled and en permit the unconsolidated material to be cored. In one case, the netration of 90 feet of such material—formerly requiring 2 weeks— as accomplished by this method in 9 hours.

From the beginning of the exploratory program, extensive use was ade of the bulldozer for trenching through overburden to expose e bodies at considerably less cost than the older hand methods. renches that would have taken half a dozen men several weeks to g with pick and shovel were excavated in a few hours by a single lldozer operator.

By placing pressure and speed gages on hydraulic-feed diamond rills and correlating the results with the type of rock and percentage core recovery, the Bureau hopes to improve and perfect control of rilling operations.

Geophysical exploration methods are being more widely used and seful new instruments are being perfected. For example, a sturdy, lf-leveling magnotometer has been developed which is sensitive ough for most purposes and which permits set-ups to be made and adings to be taken in about half the time needed with other instru- ents.

As mining problems also must be solved to obtain maximum production of domestic mineral resources, the Bureau, at its Mount Weather Testing Adit, developed a method of tamping blast holes which has saved 25 percent in dynamite consumption at several operating mines where the procedure was adopted. The Bureau continued its work in developing new uses for the microseismic method of determining rock pressure. Two investigations in progress may ultimately lead to the recovery of several million tons of high-grade ores from mine pillars.

In the field of metallurgical research, the Bureau's Pacific Experiment Station at Berkeley, Calif., during the war developed fundamental data for compounds involved in processes under study at other experiment stations and pilot plants, while the Rare and Precious Metals Experiment Station at Reno, Nev., functioned primarily as an analytical laboratory serving exploration projects for war minerals.

Iron, Steel, and Ferro-alloys

Continuing its search for additional reserves of iron ore and ancillary materials required for a record steel production, the Bureau of Mines explored by drilling, trenching, or tunneling 76 deposits in 27 States and Alaska. These included 32 iron, 16 fluorspar, 10 coal, 6 manganese, 5 tungsten, 5 nickel, and 2 chromium deposits. In addition, some 450 deposits were examined by Bureau engineers.

Important reserves of iron ore aggregating many millions of tons were indicated in Arizona, Utah, Alaska, New Jersey, New York, Pennsylvania, Missouri, and Virginia. Studies made in Alabama offer promise that significant tonnages of usable ore may be recovered from the tailings of former operations.

Results of pilot-plant and cooperative investigations on manganese during the year justify the prediction that the United States may be considerably less dependent in the future upon foreign sources of this strategic metal. Tests conducted largely in cooperation with the steel industry disclosed that the electrolytic manganese produced in the Bureau's pilot plant at Boulder City, Nev., has enough applications in industry to assure an adequate market for a plant of sufficient size to attain low production costs.

The Bureau completed tests on Three Kids manganese ore from southern Nevada and made detailed estimates of capital and operating costs for a commercial plant capable of producing 40 tons of metal a day. Electrowinning campaigns also were carried out on samples of Ladd mine ore from California, carbonate nodule concentrates from Chamberlain, S. Dak., and oxide ore from the Metals Reserve Company stock pile at Deming, N. Mex. Development of Carryall mining and conical rolls separation for the Pierre manganiferous shale near Chamberlain, S. Dak., on which considerable work was one during the year, promises a substantial reduction in production osts. This development, together with the successful electrowinning campaign on nodules at Boulder City, may eventually lead to the peacetime exploitation of the South Dakota deposit, the Nation's largest manganese reserve, containing some 50 million tons of manganese in nodular form. Research continued on the production and study of alloys made with electrolytic manganese. At Salt Lake City, Utah, campaigns were carried out in the small dithionate eaching plant on manganese ores from Arizona, Nevada, and Utah.

Construction and equipment installations progressed at the new ferro-alloys pilot plants at Rolla, Mo., and Redding, Calif., while plans were completed for a similar pilot plant at Raleigh, N. C. Investigations to be made at each pilot plant will seek methods for utilizing steel and ferro-alloy raw materials occurring in the vicinity.

An electrolytic chromium pilot plant with a daily capacity of 100 pounds of metal was brought into operation at Boulder City, Nev., treating Montana chromites. At Minneapolis, Minn., agglomeration tests on mixtures of off-grade Montana chromite concentrates and Russian chromite fines yielded a satisfactory feed material for ferrochromium furnaces. Cobalt concentrates produced at Salt Lake City from low-grade, complex, cobalt-copper-silver-gold ore of Idaho's Blackbird district were treated successfully in a 5-pound-a-day electrolytic cobalt pilot plant installed during the year at Boulder City, Nev. Small-scale smelting tests on the production of nickel-iron from iron-chromium-nickel ores of Oregon and Washington were continued at Salt Lake City, and larger-scale tests are planned at the Northwest Electrodevelopment Laboratory at Albany, Oreg. Late in the year, laboratory tests on the extraction of vanadium and phosphate from extensive deposits of Wyoming shale culminated with the installation and operation of a small pilot plant at Salt Lake City.

Beneficiation tests were made on iron ores and sponge iron products in laboratories at Salt Lake City, Utah; Rolla, Mo.; Minneapolis, Minn.; Tuscaloosa, Ala.; and College Park, Md. At Tuscaloosa, significant developments were made in the hydraulic classification and flotation of Alabama iron ores. Sponge iron produced in saggers at the Canton, Ohio, and Salisbury, N. C., pilot plants and in rotary kilns at the Laramie, Wyo., and Johnstown, Pa., pilot plants of the Bureau of Mines was used successfully in melting tests at several commercial steel and wrought-iron plants. Following laboratory tests at Salt Lake City, tonnage samples of Shasta, Calif., magnetite were magnetically separated and the high-grade concentrates were reduced at the Laramie pilot plant. It was planned to use this sponge iron in steel-making investigations at Redding, Calif. After magnetic separation tests at College Park disclosed that extremely high-grade concentrate could be made from magnetite ore occurring at Cranberry, N. C., a pilot mill was installed at the deposit to produce co centrates for the Salisbury sponge iron pilot plant. The highe quality sponge iron ever made in substantial amounts was obtain from these concentrates. At Minneapolis, experiments were completed on the Brassert bubble hearth-type of reduction with hydroge and work was continued on shaft-furnace reduction of iron ore glomerules. At Salt Lake City, tests were continued on smelting an leaching methods of extracting iron and titania from the titaniferou magnetites of Iron Mountain, Wyo.

To increase supplies of critically needed acid-grade fluorspa commercial milling of material stock-piled by the Metals Reser Company was made possible by Bureau of Mines laboratory an pilot-plant flotation tests at College Park on Spanish fluorspar of hig metallurgical grade and at Rolla on similar Mexican and domest material.

Nonferrous Minerals

In the field of the nonferrous minerals—lead, zinc, copper, tin, an the various pegmatites—the Bureau of Mines simultaneously carrie on a far-reaching exploratory program, a broad research and development plan, and a major drainage project.

The exploration of 28 lead and zinc deposits in 12 States disclose large reserves in Illinois, Idaho, Nevada, Kansas, and Oklahom Bureau engineers also examined 130 additional deposits during th fiscal year.

Despite shattered, caving ground and heavy inflows of water whic retarded progress, the Leadville tunnel in Lake County, Colo., wa advanced 4,800 feet or nearly a mile in the fiscal year 1945, bringin the total advance to 6,600 feet. This tunnel project, undertaken b the direction of the Congress, was designed to provide permanen drainage for 84 mines which have been flooded and idle since 193 The purpose was to make available, upon its completion, an estimate 4 million tons of zinc, lead, and manganese ores, and revive th formerly productive Leadville district.

A major low-grade copper deposit was confirmed in Pima County Ariz., and another deposit of considerable promise was delineated i Coconino County, Ariz., as the Bureau of Mines carried out 16 exploratory projects for copper in 9 States. Another 85 deposit were examined by Bureau engineers. Private interests are conductin further exploratory work on the Pima County deposit.

Meanwhile, considerable beneficiation work was done on ores o copper, lead, and zinc at Salt Lake City, Utah; Rolla, Mo.; an College Park, Md. A pilot plant for reduction of zinc with methan gas was completed at Rolla and breaking-in operations were conducted. Cooperative investigations were continued with a commercial firm on improvements in the smelting of lead and zinc.

A lode deposit of tin on the Seward Peninsula of Alaska, which has reater potentialities than any other known domestic source of tin, as tested through diamond drilling by the Bureau of Mines. Anothr tin deposit was explored in California.

Two mercury deposits, both in California, also were diamond-drilled y the Bureau. One of these, in Napa County, is estimated to contain 0,000 flasks of recoverable mercury sealed in low-grade ore reserves. ix other mercury deposits were examined by Bureau engineers.

Six investigations in as many States were conducted on pegmatites hat yield feldspar, mica, beryl, tantalum, and lithium minerals. he principal objective of this work, which included explorations of any separate deposits, was to stimulate production of the strategic ica used in radio sets and aviation spark plugs. Forty-eight dditional deposits of mica were examined. A flotation flow sheet eveloped several years ago in the Bureau's laboratories at College ark, Md., and Tuscaloosa, Ala., made possible the erection and sucessful operation of a 750-ton-a-day mill at Kona, N. C., to supply eldspar of the grade and in the amount needed.

Nonmetallic Minerals

Anticipating a major postwar demand for the commodities made rom nonmetallic minerals—including building materials, insulating roducts, fertilizers, paints, pigments, and inorganic compounds—the ureau of Mines explored 12 deposits in 11 widely-scattered States and laska. These included sillimanite, potash, optical calcite, and sbestos deposits, together with 2 barite and 6 corundum deposits.

Georgia's and South Carolina's huge deposits of sillimanite, a aterial used in the manufacture of refractory brick for high-emperature furnaces and spark plugs, hold promise of national elf-sufficiency in this commodity, which the United States heretofore as largely imported. Mineral-dressing investigations at College ark and Tuscaloosa developed a procedure for grading sillimanite up rom 20 to 98 percent purity with high recovery, and tests at the lectrotechnical Laboratory at Norris, Tenn., indicated that sillianite concentrate can be substituted for scarce kyanite in refractory rick.

Approximately 50 deposits of nonmetallic minerals were examined y Bureau engineers. Their minerals include silica, oil shale, quartz rystals, kyanite, pearlite, pumice, talc, pyrophyllite, bentonite, and ermiculite.

Light Metals

Fortunately, the supply position of the United States improved uring 1945 in the light metals—aluminum, magnesium, and their lloys. Hence, it was necessary to mine and use only a small portion f the reserves of bauxite—estimated to total 90 million tons of all grades—indicated by large-scale exploration by the Bureau of Mine in Alabama and Arkansas.

Work continued at several laboratories and pilot plants on th extraction of alumina from low-grade bauxites, clays, and alunite, with particular emphasis on assisting in operation problems at Government owned, semicommercial alumina plants. At Bauxite, Ark., construction of a pilot bauxite mill was completed, and breaking-in operation were started. At Rolla, Mo., laboratory beneficiation studies were made on bauxites to be treated in the mill. At College Park, Md. progress was made on the recovery of magnesium and aluminum from drosses, powders, and dust. Air tabling of magnesium sawdust recovered magnesium metal of suitable purity and particle size for reduction of titanium.

Significant advancements were made in the development of a new commercial metal, ductile titanium. This project was transferred from Salt Lake City, Utah, to Boulder City, Nev., where a production rate of approximately 100 pounds of metal a week was attained. A project was begun at the Albany, Oreg., Electrodevelopment Laboratory on the reduction of zircon, which is present in Oregon beach sands. As both titanium and zirconium are reduced with magnesium, their production might offer a post-war outlet for magnesium metal. The Albany laboratory will continue development work on the carbothermic magnesium reduction process, which had been studied at Pullman, Wash., and in cooperation with the Ford Motor Co. at Dearborn, Mich.

COAL AND COAL PRODUCTS

To combat the problem of solid fuel shortages which persisted in 1945, the Bureau of Mines promoted methods for more thorough mining of coal, improved preparation and upgrading of coal for specialized uses, and secured better utilization of coal and coal products in industrial establishments and homes.

In conjunction with its well-known fuel services, the Bureau analyzed more than 20,000 samples of various fuels during the year in its laboratories. This work helped maintain fuel efficiency at Army and Navy installations, helped keep war industries operating at full capacity, aided Federal coal-mine inspectors in preventing coal-dust explosions, guided Government fuel-purchasing agents, and assisted the coal exploration and research work of the Bureau. Maintaining its consulting service for Government agencies in the purchase and utilization of fuels and fuel-burning equipment, the Bureau saved thousands of tons of coal by recommending changes in the operation of equipment at many Army camps, eliminated difficulties that prevented continuous boiler operation at two Navy land stations, chose fuels for new Veterans' Administration projects, and made scores of fuel-efficiency and equipment-acceptance tests. Federal boiler plants, including those at all Army posts, were safeguarded against boiler-scale corrosion and caustic embrittlement by the Bureau's feed-water conditioning service, and studies of corrosion in condensate return lines resulted in better protection for $300,000,000 worth of steel equipment.

Thousands of volunteers were enlisted in a Nation-wide fuel efficiency program aimed at saving 29 million tons of coal a year and proportionate economies in the commercial and industrial use of other types of fuel and energy. More than 13,000 plants and establishments pledged cooperation as a network of some 20,000 engineers and fuel experts—virtually all serving without pay—carried the campaign directly to commercial, industrial, and institutional fuel consumers. Thousands of copies of publications incorporating up-to-date information on such subjects as coal storage and use were made available to industry.

Also directed at fuel-shortage problems, Bureau studies resulted in the establishment at Philadelphia of a packaged-fuel plant for converting 150,000 tons of surplus anthracite fines into a more convenient fuel and in the blending of anthracite fines with bituminous coal for stoker use.

Coal Mining and Exploration

Cooperating with anthracite producers, the Bureau studied problems of mine flood prevention and better methods of mining the thin, steeply pitching beds that constitute a large part of remaining reserves. Determinations were made on the economic limitations of light equipment for stripping coal from outcrops in mountainous areas. Coal fields of the West, South, and East were explored for minable reserves of coking coals, and the Pacific Northwest was scoured for adequate fuel supplies to relieve an acute shortage in that area. Laboratory petrographic examinations and coking tests were made on more than 150 coals of the United States, Chile, and China, and methods of increasing the production of Chilean coals were investigated.

Gas- and Dust-Explosion Research

To reduce explosion hazards in coal mines and many types of plants, tests were made on industrial powders, dust, and vapor-air mixtures. Recommendations and safety codes were formulated for plants producing explosive materials and dust, and specifications for conductive footwear and flooring materials were developed to lessen hazards of explosions from static electricity. Conditions permitting the safe use of larger charges of explosives in coal mines were determined by tests.

Coal Preparation and Storage

To augment diminishing reserves of high-rank coking coals and to up-grade marginal and lower-rank coals, studies were made on preparatory treatments to reduce sulfur and ash in coking coals and on the salvaging of refuse coal at points of origin. The distribution of sulfur in the coking coals of Greene County, Pa., was determined, and concentrating tables were found effective for recovering coke breeze from dumps. Two Alabama companies based designs for coal-preparation plants on washability data provided by the Bureau. Laboratory studies were made on the storage properties of about 35 coals.

Coal Combustion

Keeping pace with new developments in order to improve its service to industry, the Bureau of Mines became the first in the United States to employ the electron microscope for determining the surface area and size distribution of powdered coal. Needed information was provided on the burning characteristics of war-emergency fuels, including some produced by new processes. The Bureau developed apparatus to measure the thermal conductivity of coal-ash slags, permitting the study of slag deposits on boiler tubes from melted coal ash to provide the data required for improving the design and operating efficiency of boiler furnaces. Fundamental data were obtained in a study of more than 200 ash analyses, and studies of slagging and atmospheric conditions around furnace walls demonstrated one cause of tube failure and lessened boiler "outage," or time lost in maintenance and repairs.

Coking and Gasification Studies

Progress was made on two processes which offer promise of a cheap source of materials for a multitude of purposes. In the first, carbon monoxide of relatively high purity was produced by burning pitch coke or petroleum coke with oxygen. In the second, the Nation's immense reserves of lignite were brought closer to industrial use through the successful testing of a large retort for producing carbon monoxide and hydrogen from lignite by gasification. Evaluation of the gas- and coke-making properties of coals from newly developed fields greatly benefitted the coke and gas industries. Greater production and a more uniform grade product were obtained without increased capital or labor costs at several coke plants using the Bureau's data on coal bulk-density control, and others receiving direct technical assistance also reported higher operating efficiencies and increased outputs.

Synthetic Liquid Fuels

Major strides were made in the fiscal year 1945 toward the objectives set forth by the Congress in the Synthetic Liquid Fuels Act

ublic Law 290), which commissioned the Bureau of Mines to
lertake a 5-year, $30,000,000 research and development program
lemonstrate and to provide private industry with the "know how"
making synthetic fuels from American coals and oil shales.

Vith sites chosen and construction under way at the end of the year
three of the four major installations required, research also was in
gress in temporary laboratories. Buildings were being erected
l equipment installed for a coal research and development labora-
y at Bruceton, Pa., an oil-shale demonstration plant near Rifle,
o., and an oil-shale research and development laboratory at
ramie, Wyo. The announcement of the location of the fourth and
l installation—a demonstration plant for the production of oil
l gasoline from coal by the hydrogenation and gas synthesis proc-
es—was expected shortly, for detailed information already had
n collected and analyzed on 206 proposed sites, in 21 States, in-
ding several war plants suitable for conversion. This demonstra-
n plant, which will produce 200 barrels of oil a day by each process
compared to 1 to 2 barrels a day from the preliminary pilot
nts, will be designed to incorporate new German developments and
as obtained in a study made during the year of captured documents
l synthetic fuel plants.

At nearby Pittsburgh, a staff of more than 100 persons who will
rate the Bruceton, Pa., laboratory is now engaged in fundamental
earch, process development, and engineering design. Progress has
n made in developing an internally cooled converter designed to
luce the steel requirements for each production unit to one-fifth or
n one-tenth of that required in the present European equipment.
e effects of variables such as catalyst, temperature, and contact
ne on the primary liquefaction of coal by hydrogenation have been
died, and the experimental hydrogenation unit has been operated
a Bureau-developed process for the production of fuel oil from coal.

At Laramie, Wyo., research also was conducted in temporary
arters to obtain fundamental data needed for the design of experi-
ntal and demonstration plants for producing marketable products
m oil shale. Among the investigations begun was the so-called
ermal solution method in which the oil shale is heated to moderate
nperatures (400° C.) in the presence of a solvent such as shale oil
d then extracted with a more volatile solvent.

At Rifle, Colo., construction on the demonstration plant, roads,
lities, and housing was in progress at the close of the fiscal year.
e processing section of the plant was designed to have retorts of
eral types, handling 25 to 100 tons of shale each per day, as
ll as equipment for refining the shale oil to produce salable prod-
ts. A mine was opened which will provide up to 200 tons of shale

daily for the retorts, develop low-cost methods of mining oil shale, an demonstrate the costs of mining on a large scale.

PETROLEUM AND NATURAL GAS

To offset in some measure the immense withdrawals from the Nation's oil reserves during the war, the Bureau of Mines has stressed three-phase program of conservation and better utilization, the objectives being to increase primary recovery of oil through mor efficient utilization of the energy impounded with the oil in the nativ reservoir, to stimulate secondary recovery of oil from old fields, an to enhance the use of crude oils containing sulfur compounds whic the refiners regard as undesirable. Unaltered by the weakening o enemy resistance, these are basic, long-range objectives in the fiel of petroleum and natural gas, and the Bureau's research toward thei attainment will be continued.

In 1945, studies of primary methods of crude-oil extraction wer intensified in the California, Rocky Mountain, and Gulf Coast field with particular emphasis upon the gas-condensate reservoirs of th latter region. Engineering analyses of reservoir data were mad for the operators and Government agencies concerned with thre gas-condensate fields, each with multiple-zone production. Flow characteristics and other properties of the fluids from two of th reservoirs were determined on the spot in a specially designed mobil pilot plant, and fluids from the third reservoir were collected for subsequent laboratory analysis. In a study of reservoir conditions in Naval Petroleum Reserve No. 1 at Elk Hills, Calif., the Bureau performed service for the Navy and unit operators by analyzing more than 600 samples of unconsolidated cores and by determining gas-liberation and shrinkage data as well as other physical characteristics of the reservoir oils.

In Oklahoma's West Edmond field, a technique of diamond coring was introduced which has wide application in other fields where the use of steel bits causes low core recoveries.

The internal corrosion of tubing and wellhead equipment in fields where high pressures and temperatures exist has become a serious menace to life and property. Laboratory corrosion tests conducted by the Bureau under controlled conditions simulating those found in field practice indicated the probable corrosive effects of carbon dioxide and organic acids and disclosed the protective values of different chemical inhibitors.

Extending their research on stimulative methods of secondary recovery in fields long past their peak of production, Bureau engineers prepared reports on such operations in Illinois and the Appalachian region and on the history of water-flooding operations in Kansas. New techniques were developed in the water and core oratories which aided greatly in the interpretation of field data. ntamination of oil-field cores by "oil-base" muds was studied insively. A pilot-plant process yielding a 90-percent recovery o microcrystalline wax distillate from tank-bottom settlings was veloped successfully after many technical operating difficulties re overcome.

Wartime petroleum chemistry and refining research of the Bureau Mines—involving superfractionation, hydrocarbon analysis, and gine testing of fuels—was channeled toward the maximum utiliztion of the less desirable domestic crude oils in aviation and other fels. To this end, a comprehensive investigation was undertaken on sulfur-bearing oils. Postwar developments will demand ineased knowledge of the composition of petroleum, and the Bureau's rtime studies of aviation fuels will form the groundwork for rearch programs to obtain accurate information on the hydrocarbon mposition and properties of distillates from all types of crude oils. uring the year, 32 special restricted reports containing some 600 ges upon several phases of the aviation-fuel work were made availle to refiners and members of technical committees. Many of ese data will be applicable to postwar refining of aviation, motor, d Diesel fuels.

Precise values of certain fundamental thermodynamic constants ere determined on 11 different pure hydrocarbons, heats of combuson were ascertained on blended fuels proposed for use in the latest pes of aviation engines, and preliminary work was done on lead tra-ethyl. The completion of a hydrogen liquefaction plant permitd the extension of low-temperature research to 435° below zero ahrenheit).

HELIUM

Direct war uses of helium—a lightweight, nonflammable gas prouced solely by the Bureau of Mines—declined somewhat in 1945, but ommercial demand increased some 65 percent and other war-suporting uses also increased, permitting production to continue at pproximately the same rate as last year.

The Bureau's helium plant at Otis, Kans., was awarded the Army nd Navy "E" for outstanding production, and the plants at Amarillo nd Exell, Tex., each received a star for their Army and Navy "E" ags.

To conserve helium for future use, the Bureau established a gigantic nderground cache by injecting all produced in excess of military and ndustrial needs into the Government-owned Cliffside gas field. This elium was extracted from natural gas being delivered by private roducers to domestic and commercial markets and otherwise would ave been lost. Helium in Government-owned fields also was conserved by increasing the proportion taken from privately ov natural gas.

Now used as a tracer gas in underground oil and gas reservoi determine flow conditions, helium has provided the petroleum indu with a new and important tool. Bureau engineers introduced technique in the Elk Hills Naval Petroleum Reserve with si success. Many other industrial applications of helium have developed to supplement its principal employment in the inflatio lighter-than-air craft. The Bureau of Mines, with its present fa ties, stands ready to meet the demand occasioned by these and other new uses still in the development stage.

EXPLOSIVES RESEARCH

Fostering the protection of life and property, the Bureau of M made many special investigations for industry and the armed fo on the safe manufacture and handling of explosives and explo materials. In the course of these studies, the Bureau's technici made more than 400 chemical analyses, 2,700 gallery tests, and 2, other control tests.

Research on the explosive properties of important combust liquids and gases, such as high-octane gasoline and materials synthetic rubber, enabled the Bureau to develop methods for p venting explosions. Inert atmospheres, for example, were used loading incendiary war materials.

An investigation of the numerous acetylene generator explosi in shipyards, which was undertaken at the request of the War Prod tion Board, disclosed that inferior carbide and improper genera operation caused a number of these disasters.

Following an extensive investigation of a disastrous fire wh broke out when a storage tank containing liquefied natural failed at Cleveland, Ohio, on October 20, 1944, the Bureau of Mi prepared detailed recommendations for preventing the recurrence such disasters.

To avoid fires and explosions caused by sparks and arcs from b electric trolley wires in gassy and dusty coal mines, the Bure encouraged the development of Diesel mine locomotives by p paring a schedule of permissible requirements for such locomotives.

To assist mines in meeting increased demands for coal, the Bure determined the conditions under which the permissible charge explosives may be increased from 1.5 to 3 pounds. A new sched also was published which set forth the conditions under which perm sible blasting devices can be fired without stemming. Sheath explosives reduce or prevent fires and explosions caused by blasti in coal mines, but sheaths may increase toxic gas emissions und certain conditions and these are being studied. Hazards associat with the use of liquid-oxygen explosives also were being evaluated.

New equipment for testing explosives and detonators was intervals cluding an electronic chronoscope that will measure time invented, a millionth of a second. Five more explosives were added to the t of permissible explosives, which now includes 178.

Cooperating with the War and Navy Departments, the Bureau etermined experimentally hazards involved in the handling and torage of military explosives and incendiary materials, and a member the Bureau's staff served as chairman of the Army-Navy-Bureau of ines Board on the Storage of Smokeless Powder. A related study is progress on the hazards associated with static sparks.

SAFETY, PLANT PROTECTION, AND HEALTH ACTIVITIES

An acute need for increasing war production in the mineral industries espite manpower and equipment shortages lent added significance to he safety and security programs of the Bureau of Mines in the fiscal ear 1945.

Under these programs, the Bureau performed a multiplicity of rvices—virtually all devoted basically to the conservation of essential anpower and equipment in these industries. These services included afety education, accident-prevention training, accident investi- ations, material and equipment tests, coal-mine inspections and eports, prevention of sabotage with the cooperation of the armed orces, explosives control, and field and laboratory studies on the ccurrence of gases, dust, temperatures, and other conditions affecting he health of mine workers.

The influence of the Bureau's safety programs upon the accident ecords of the mineral industries cannot be measured with exactitude, but it is significant that coal-mine fatality rates declined to the low- st point in the Nation's history.

Fewer American mine workers lost their lives for each million tons of coal produced in 1944 than in any other year on record. Despite numerous unfavorable safety factors incident to a war economy, ncluding the necessity for producing a maximum quantity of coal, between 150 and 200 lives were saved in coal mines as compared with the previous year. The fatality rate for the first 6 months of 1945 likewise shows a heavy reduction over the same period in 1944. In fact, nearly 4,000 coal miners are alive today who might have perished during the last 3½ war years had coal-mine fatality rates remained at the levels of World War I.

Safety Work

The safety educational and investigative field work of the Bureau of Mines, an invaluable service to industry for more than 3 decades, is correlated and directed by the supervising engineers of the eight districts into which the country has been divided. These men, veterans of many years experience in industrial safety work, als administered coal-mine inspection, explosives control, and minera production security activities within their respective districts.

During the fiscal year 1945, the Bureau's safety engineers and instructors trained more than 18,000 employees of mining and allie industries in first-aid and mine rescue procedures, increasing to mor than 1,600,000 the total number of persons given these courses sinc the establishment of the Bureau in 1910. These men also assisted i conducting 22 first-aid contests in five States. About 1,200 worker and officials in the mineral industries completed Bureau courses i accident prevention, and approximately the same number receive partial training.

In this safety-education program, the Bureau utilized extensivel motion pictures, slides, demonstrations, and similar visual educationa methods. Sound motion pictures were exhibited 231 times at safet meetings, and Bureau representatives attended and addressed 49 safety meetings in 29 States.

At virtually all major mine disasters occurring during the year Bureau personnel assisted in the rescue and recovery operations whic usually are arduous and dangerous in character. The aid thus rendered often enabled the mines concerned to resume production a relatively earlier dates. In all, Bureau engineers investigated 31 min explosions in 31 States, 52 mine fires in 20 States, and 132 miscellaneous accidents in 30 States.

Following investigations in which 1,327 explosion tests were made the Bureau gave its official sanction and approval to 26 units of electrical equipment designed for safe operation in gassy mines. Special investigations were continued on the design of safety equipment for naval use.

Had such services as first-aid and mine rescue instruction, accident-prevention training, accident investigation, disaster recovery work, equipment tests, and safety research been available from private sources, it is estimated that they would have cost the mineral industries considerably more than $1,000,000 during the year. Such services could not be provided, however, by any means other than a similar national organization.

Coal-Mine Inspection

In the fiscal year 1945, Bureau of Mines representatives made 3,163 inspections and reports on coal mines producing approximately 91 percent of the Nation's total annual output. The reports on these safety surveys, most of which were reinspections, demonstrated an increasing acceptance of the Federal safety recommendations by the coal-mining industry, for hundreds of proposed improvements had been made in the mines since the previous inspections.

Virtually all of the mines in the United States employing 25 or more en now have been inspected at least once, and many have been amined several times. Greater attention was given last year to ines employing fewer than 25 men, more than 100 such mines ing inspected. In accordance with an order from the Secretary of e Interior on July 1, 1944, the Bureau of Mines assumed respon- bility for safety inspections of mining operations on the public omain, Indian lands, and other Government-lease operations for- erly inspected by the Geological Survey. Many of these are small ines which ordinarily would not be inspected by the Bureau.

Federal coal-mine inspection has a definite dollar value to the dustry, for accident reductions actually attained resulted in a money ving to the industry, considerably in excess of the hypothetical cost timates.

Fatal and nonfatal accidents in the Nation's coal mines were re- uced approximately 11 percent in 1944 as compared with 1943. On he usual basis for computing direct and indirect accident costs, this duction represents a saving of upward of $6,000,000 to the industry. nquestionably the mines of the country are in a much safer condi- on today than they were before the advent of the Federal inspection rogram, and this program has been a large factor in bringing this ondition about. The program also has influenced some States to odify their mining laws to parallel in part the Bureau's inspection andards.

Antisabotage

When activities under the mineral-production security program of he Bureau of Mines were ended officially on June 30, 1945, the World Var II record of the Nation's mineral industries remained unblemished y a single known case of sabotage. In the absence of any subversive cts—and even a few might have seriously crippled the war program— t obviously is difficult to assess the extent to which the Bureau's ctivities are responsible for their prevention, but is believed to be ppreciable. Cooperating closely with the Internal Security Division f the Office of the Provost Marshal General, the Bureau's engineers nade surveys during the year at 36 facilities not formerly inspected, hus increasing to 2,911 the total number of mines, mills, smelters, nd refineries inspected during the life of this program. Recurring nspections made at intervals of 90 days at the more important acilities totaled 395 for the year, or a total of 1,598 reinspections luring the past 3 years.

Security inspections at coal mines were discontinued at the end of June 1944, permitting the reduction of field engineers engaged in this work to 16. The defeat of Germany made further curtailments possible, and the working agreement between the Bureau of Mines and the War Department was terminated in May 1945.

Explosives Regulation

At the direction of the Congress, the Bureau of Mines maintaine close surveillance over the millions of pounds of nonmilitary explosiv used during the year by American industries to make certain tha none fell into subversive hands.

The Federal Explosives Act was administered through an organiz tion of some 3,900 cooperating licensing agents serving without pay, least 1 being designated in nearly every county of the United State for the convenience of applicants. In the fiscal year 1945, approx mately 90,000 licenses were issued to individuals and firms requirin explosives, which increased the total number of licenses approve during the war to about 760,000, including reissuances.

Since the work was undertaken, the Bureau has found it necessar to revoke only 56 licenses, indicating that compliance has bee obtained with a minimum of interference with business and industry Most of the violations resulted from ignorance of the Federal require ments, and 14 of the revoked licenses have been restored upon reques and assurances by the licensees that they would in the future compl with the act and regulations.

During the year, Bureau investigators inspected or reinspecte more than 16,000 explosives magazines and submitted reports on eac to the Washington office. In consequence, more than 7,500 letters o instruction or recommendation on safe practices were transmitted t licensees, and the replies indicated that 5,188 explosives magazine were improved to comply with minimum standards of constructio and locking to minimize thefts.

Explosives control funds were reduced substantially at the end o the war, and early termination of this work was anticipated.

Health Work

Two broad objectives in the Bureau's over-all program—acciden prevention and better working conditions in the mineral industries—were furthered materially by the analysis of numerous gas and dus samples, improvement of procedures for determining atmospheri contaminants, inspections of unhygienic conditions with recommendations for control measures, approval testing of respiratory protectiv devices, and determination of toxic gases produced by decompositio of cable insulation and plastic materials used in electrical equipment.

Approximately 19,000 samples of gas and dust were analyzed, guiding Bureau technicians in preparing recommendations to curb explosion and health hazards in mines, aiding in the control and extinguishment of mine fires, and determining places in mines where dangerous quantities of methane were being released, where ventilation was inadequate, and where injurious concentrations of harmful gases and dusts were present. The results also were helpful in evaluating hazards ociated with noxious gases in tunnels and military establishments, haust gases from Diesel locomotives, and rock-dusting materials.

Owing to the importance of the analyses of gas and dust samples in aluating hazardous conditions, studies were continued to improve the various analytical procedures used for determining atmospheric ntaminants. Definite advances were made in methods for collecting and indicating the concentration of dust and other injurious contaminants in the air.

Dust studies were made in more than 50 anthracite and bituminous-coal mines, and encouraging results have been obtained in the control o coal dust through better utilization of water to allay it and more ficient ventilation to dilute it to concentrations that are not harmful. irect assistance was given in numerous instances in the installation o control measures, and indirect assistance was given by training ine personnel in dust collection and analysis techniques and by roviding information on the effects and control of harmful substances. nspections were made of change houses at both anthracite and tuminous-coal mines, and information will be published on the construction and operation of best types.

Approval testing of respirators was continued, and information on eir proper use and maintenance was disseminated. A new approval hedule for nonemergency gas respirators was issued.

Observations were continued on the use of Diesel locomotives, tests eing made in tunnels and roundhouses.

Confidential studies were conducted for the Navy Department's ureau of Ships on the performance of various gas-indicating instruments and on the nature of the gaseous decomposition products of ectric cable insulation and of thermosetting synthetic resins. This formation will be of value in combating hazards in the mineral dustries when these materials receive industrial application.

ECONOMICS OF MINERAL INDUSTRIES

The reduced military requirements for many metals and minerals nd the gradual relaxation of restrictions on civilian uses subsequent o victory in Europe brought about various revisions in the economics nd statistics services of the Bureau of Mines at the close of the fiscal ear. These services which had provided invaluable information on roduction, stocks, distribution, and consumption of minerals for the uidance of industry and Government during the war were modified o meet the needs of the reconversion period. A host of new problems demanding immediate attention required a slight expansion of his fact-finding program.

The war had clearly demonstrated the need for importation of inerals not available in adequate quantities from domestic sources, mpelling the Bureau to give more consideration to foreign supply and to the conservational aspects of mineral utilization. In additio the disposition of immense quantities of scrap metal, the need fo national stock piles of strategic and critical materials, and simila controversial but vital problems arose. The Bureau of Mines immediately began the collection, interpretation, and dissemination o the up-to-date, accurate information necessary for a solution o these problems.

In mobilizing for effective action, the Bureau did not overloo other postwar problems of mineral supply and development. Marketing studies and other types of economic analysis as well as basic fact finding are required by industry to meet reconversion questions an by Government to determine sound policies for utilization of surplu war plants, to appraise postwar prospects for employment in th mineral industries, and to plan for the wide use of mineral resources i river-valley projects. The mounting costs of mineral productio require careful study of the effects of taxation, transportation, wages and other cost factors on the conservational use of mineral resources Although the Bureau was insufficiently staffed for work of this kind the program was initiated pending the anticipated granting of increased appropriations by the Congress for these studies.

Metals

During the fiscal year 1945, the peak was passed in the wartim effort to obtain a balance between mineral supplies and requirements Plans for a smooth and orderly transition from war to peacetim activities in the metal industry began to take shape in a perio which began shortly after the successful Allied landing on the Normandy coast.

Originally organized to meet growing industrial and governmenta needs for factual information on the status of nearly all metals, th metal-reporting service of the Bureau of Mines was broadened durin the early phases of the war to provide more frequently and in greate detail the basic data required by war agencies to direct and contro distribution for military and essential civilian products. Now, i addition to the extensive series of confidential and published reports numerous special studies were made for use in stock-pile planning surplus industrial property disposal, standard commodity classification, and other programs of various agencies.

Victories in the military campaigns permitted a broad relaxatio of censorship rules at about midyear. In view of the great numbe of requests for economic and statistical data which were received indicating a growing conciousness by industry of the need for authoritative, factual information for guidance in the reconversion and postwar period, the Bureau made preparations to revise various metal canvasses which it has regularly conducted so as to include the esirable features of those carried out by war agencies in order that ontinuity would not be interrupted when the emergency agencies vere disbanded.

Nonmetallics

Supplementing its regular annual and other periodic statistical eports in the highly diversified field of nonmetallic minerals, the ureau of Mines prepared for the war agencies special monthly or uarterly canvasses on minerals of noteworthy military importance nd provided the answers to inquiries on current supply situation, ew developments and uses, and various other factors associated vith the industries.

To make this service possible, the Bureau's extensive information iles on the nonmetallics were augmented with several thousand items f current data. Furthermore, field trips were made to areas where upply problems demanded attention with respect to such war minrals as asbestos, barite, graphite, and magnesite. For the third vear, the Bureau prepared monthly and confidential series entitled 'Mineral Trade Notes'' and comprising abstracts of consular and ther reports primarily on foreign mineral developments, for use of various war agencies.

Special reports were written on such critical minerals as optical rystals, graphite, corundum, and phosphate rock. A comprehensive urvey was prepared covering international trade in all nonmetallics, nd a 33-year history of the chemical raw material and fertilizer industries was issued. General reviews were compiled for the technical ress of all major developments in the broad and complex field of onmetallic minerals.

Petroleum and Natural Gas

During the war, much of the information normally published by the Bureau of Mines on the production and demand for crude petroleum, natural gas, and their products was available for confidential use by Government agencies only. In anticipation of the termination of such restrictions, the Bureau undertook to prepare special reports to show the major changes in demand on the domestic and world markets.

In the United States, the major oil problems of the postwar period will include the future rate of crude production, restoration of the normal supply of motor vehicles, and the expansion of aviation. Outside the United States, the discovery of new reserves in the Middle East, the increase in crude production in the Caribbean region, the restoration of devastated refineries and oil fields, and the future rate of consumption in enemy countries will materially change the international trade in crude oil and its products and make essential more complete and accurate information on oil supply and demand.

During the year, the Bureau of Mines made numerous speci economic studies of distribution and trends of consumption in the fiel of petroleum. Its work also included collection of comprehensiv statistics on refinery operation, including the production of aviatio gasoline; the preparation of monthly forecasts of demand for crud petroleum; an annual survey of the consumption of fuel oils by State and uses; the production and distribution of natural gas, natura gasoline, related products, and carbon black; and assembly of dat on foreign oil production and competitive trends in international trad in crude petroleum and refined products.

Well-developed before the war, the Bureau's services made possibl an accurate analysis of the changes in demand during the war and wil be of equal value in indicating postwar readjustments.

Coal

Now encompassing bituminous coal as well as anthracite, lignite and other solid fuels and byproducts, the detailed studies of th Bureau of Mines on requirements, production, shipments, and use provided information indispensable to carrying out the distributio and pricing programs of the Solid Fuels Administration, War Production Board, Office of Price Administration, and other Governmen agencies concerned with solid-fuel shortages. This informatio served as a basis for the equitable distribution of anthracite, coke and special-purpose coals at a time of unprecedented demand an acute shortage. When broad-wage-scale revisions in all producin coal fields required corresponding changes in maximum prices, th statistical facilities and trained personnel of the Bureau were mad available to the war agencies in working out the adjustments.

Well-established weekly, monthly, and annual reports publishe by the Bureau were continued on an expanded scale, particularl those concerning the distribution of bituminous coal, anthracite and lignite. Detailed studies were made on the production, consumption, and resources of coal in eastern European and Far Easter countries at the request of the Combined Production and Resource Board. Staff members also worked closely with the Technica Industrial Disarmament Committee in the preparation of a repor on the German solid fuels industries from a standpoint of international security.

Foreign Minerals

A program for postwar activity initiated a year ago developed during the fiscal year 1945 to a stage where adjustments in policy and procedure were required to enable the Bureau of Mines to participate more actively in foreign investigations.

If the Congress approves legislation sponsored by the Department of State, the Bureau proposes to establish 18 regions throughout the orld and assign competent technical specialists to the United States oreign Service to aid this Government on problems relating to ıpplies of mineral raw materials. At the request of the Department f State, the Bureau now is extending mining and metallurgical echnical assistance to Brazil under a $25,000 congressional approriation which restricts the investigations to those minerals in which he United States is deficient.

Several Bureau engineers visited Mediterranean and other European reas as studies of foreign mineral resources were extended to include reas liberated during the fiscal year 1945.

Accident and Employment Data

With critical labor shortages in the mineral industries focusing ttention on accident prevention as a primary means of conserving nanpower, information compiled by the Bureau of Mines on frequencies nd causes of accidents and related employment data were used videly by the War Manpower Commission, War Production Board, nd other Federal agencies charged with war labor procurement and roduction maintenance duties.

A confidential monthly series of employment and productivity lata on bituminous-coal mines, assembled on a Nation-wide basis and later on a State basis were supplied to several war agencies. Mineral industry employment information was used to gage transfers of labor from unessential to necessary mining or war work and to measure the effective mine-labor force in localities and regions.

Detailed analyses of individual accident reports on the cause and severity of coal-mine injuries were undertaken through the Coal Mine Inspection Act as a standard feature of the Bureau's work. In addition to usual uses, virtually all of the regular accident statictics on the metal, nonmetal, and mineral fuel industries were used in one or more ways for war purposes. Facts on the constituents and consumption of industrial explosives were required by the armed forces as well as by those permanently interested in explosives production and markets.

PUBLIC REPORTS

During 1945 the volume of publications prepared and issued by the Bureau of Mines increased somewhat in response to a rising demand from industry, war agencies, and the public for informative material on virtually every subject associated with the mineral industries. In all, there were 660 publications, which required editing 20,520 pages of copy, reading proof, and preparing 2,437 illustrations for processing. The publications included 124 bulletins, technical papers, Minerals Yearbook chapters, miners' circulars, and other printed reports; 230 special war minerals reports for restricted use; 107 reports of investigations and information circulars; 177 speeches and papers for the technical press; and 22 miscellaneous manuscript together with numerous periodic statistical reports for industry.

As in all the war years, however, the number of copies printe and distributed was restricted to the barest minimum to save fund and paper and the total number of copies issued remained substan tially unchanged. Security restrictions on the distribution of th Minerals Yearbook were lifted after VE-day, making this authoritativ publication again available.

The Bureau's Washington library of selected reference materia was increased by 2,351 books and pamphlets and 207 bound volume of periodicals; 247 periodicals were received regularly; and 19,61 books and periodicals were loaned for use outside the library. Ap proximately 5,000 readers visited the library for reference work and about 4,500 telephone calls were received. The catalog of th library's collections was increased by 8,066 cards.

Free educational motion-picture films, produced under the Bureau' supervision and paid for by private industry, were shown on 84,95 occasions to audiences totaling 7,932,361 persons. Three new soun films entitled Sand and Flame, A Story of Copper, and A Story o Arc Welding, were added to the Bureau's library of more than 10,00 reels. The last-named is the first Bureau film in technicolor. Thes films, shown in many countries, were in constant demand for wa training and rehabilitation classes, Army and Navy personnel, engineering and scientific societies, business and civic groups, school and colleges, and other groups.

The Bureau continued to effectuate its policy of the widest possibl dissemination of its technologic, economic, and scientific informatio consistent with national security, and made plans for reprinting and even wider distribution of its reports upon the termination o hostilities, in response to an ever-growing demand from industry for such information.

ADMINISTRATION

As in past years, activities of the Bureau of Mines were administered from Washington, D. C., but were carried on largely in the field offices, laboratories, and pilot plants. To handle more efficiently the larg volume of administrative work, an Administrative Service was organized to include the divisions of Personnel, Field and Property, an Budget and Finance.

Personnel

On June 30, 1945, there were 3,974 full-time employees in the ureau of Mines, distributed as follows:

Classification and number of appointees

	P & S	SP [1]	CAF	CPC [2]	Total
epartment	138	3	622	11	774
ield	920	364	763	1,153	3,200
Total	1,058	367	1,385	1,164	3,974

[1] Includes instrument makers, safety instructors, laboratory aids, assistants, etc.
[2] Includes laborers, mechanics, messengers, wage employees, etc.

Property

As of June 30, 1945, the property of the Bureau had a total cost of 9,960,310.98, of which $3,114,745.06 was for land, buildings, and mprovements; $2,368,139.74 for laboratory equipment; $1,720,908.57 or machinery and power-plant equipment; and the remainder for ffice furniture and equipment, automobiles and trucks, rescue cars nd specialized apparatus, and other goods.

Finance

The total funds available to the Bureau of Mines for the fiscal year nded June 30, 1945, including direct appropriations, departmental llotments, reappropriated balances, and sums transferred from ther departments for service work, were $28,988,520. Of this amount 20,926,543 was spent, leaving an unexpended balance of $8,061,977. n the regular work of the Bureau, $19,162,455 was expended. These igures are subject to revision because of unpaid obligations.

Table 1 presents classified information regarding the financial istory of the Bureau for the fiscal years ended June 30, 1942–46.

Table 2 gives a statement of the distribution of congressional ppropriations to the services and divisions and the expenditure of hese funds in 1945 by Bureau divisions.

TABLE 1.—Bureau of Mines appropriations and expenditures, fiscal years ended June 30, 1942–46

Fiscal year	Appropriated to Bureau of Mines	Departmental allotments [1]	Funds transferred from other departments [2]	Total funds available for expenditure	Unexpended balances	Total expenditures	Expenditures, exclusive of service items [3]
1942	$8, 910, 388. 68	$97, 490	$2, 223, 026. 41	[4] $11, 230, 905. 09	[5] $1, 823, 415. 21	$9, 407, 489. 88	$8, 747, 726. 21
1943	28, 707, 630. 94	106, 450	2, 567, 615. 26	[5] 32, 168, 548. 20	[6] 5, 851, 566. 64	26, 316, 981. 56	25, 178, 429. 84
1944	20, 969, 098. 00	91, 300	3, 460, 898. 00	[6] 25, 476, 222. 00	[7] 5, 654, 660. 00	19, 821, 562. 00	17, 962, 090. 00
1945	22, 195, 136. 55	91, 500	6, 260, 167. 74	[7] 28, 988, 520. 00	[8] 8, 061, 977. 00	20, 926, 543. 00	19, 162, 455. 00
1946	18, 979, 984. 38	[9] 6, 500	2, 592, 161. 00	[8] 21, 578, 645. 38			

[1] Includes printing and binding, stationery, and contingent funds.

[2] Includes proceeds from sales of residue gas.

[3] Service items include helium, and other investigations and services for other departments.

[4] Includes $914,718.39 unexpended balance reappropriated, and balance of $79,002.28 receipts from sale of helium and other products.

[5] Includes $976,885.27 unexpended balance reappropriated, and balance of $128,018.51 receipts from sale of helium and other products.

[6] Includes $4,606,720.72 unexpended balance reappropriated, and balance of $202,723.66 receipts from sale of helium and other products.

[7] Includes $4,603,644 unexpended balance reappropriated, and balance of $291,152 receipts from sale of helium and other products.

[8] Includes $4,720,098 unexpended balance reappropriated, and balance of $385,684 receipts from sale of helium and other products.

[9] Includes stationery and contingent funds.

Division or branch	Salaries and expenses	Operating rescue cars and stations and investigation of accidents	Coal-mine inspections and investigations	Salaries and expenses, enforcement of Federal Explosives Act	Protection of mineral resources and facilities, including petroleum	Testing fuel	Anthracite investigations	Synthetic liquid fuels	Mineral mining investigations	Oil and gas investigations	Purchase of land, etc., Bartlesville, Okla.	Expenses mining experiment stations	Care, etc., buildings and grounds, Pittsburgh, Pa.
Office of the Director	$29, 309	$173										$81	
Office of Minerals Reports		23, 891	$32, 950	$6, 643	$8, 664	$8, 547	$3, 163	$12, 774		$2, 391		25, 781	
Total	29, 309	24, 064	32, 950	6, 643	8, 664	8, 547	3, 163	12, 774		2, 391		25, 862	
Administrative Service	42, 012	12, 422	18, 529	35, 121	313	4, 145	428	59, 148	$18, 220	33, 319		19, 721	$58
Mining and Metallurgical Branch									110, 154			18, 155	
Central region									39, 525			55, 210	
Eastern region									68, 357			319, 778	
Western region									173, 435			475, 362	
Fuels and Explosives Branch:													
Fuels Division		195, 726	30, 261	2, 438	1, 752	426, 120	76, 409	11, 781	15, 302				159, 239
Explosives Division		90, 554		73, 155									
Petroleum and Natural Gas Division								1, 079, 064		620, 532	$3, 477		
Synthetic Liquid Fuels Division								1, 433, 834					
Total		286, 280	30, 261	75, 593	1, 752	426, 120	76, 409	2, 524, 679	15, 302	620, 532	3, 477		159, 239
Economics and Statistics Branch:													
Coal Economics Division													
Foreign Minerals Division													
Metal Economics Division													
Accident Analysis Division			16, 461										
Nonmetals Economics Division													
Petroleum Economics Division													
Total			16, 461										
Health and Safety Branch:													
Coal Mine Inspection Division			829, 820										
Safety Division		400, 911	15, 554										
Health Division		60, 371	59, 738		1, 460								
Mineral Protection Division					133, 900								
Explosives Control Division				419, 239									
Total		461, 282	905, 112	419, 239	135, 360								
Total appropriations	76, 165	797, 595	1, 024, 480	575, 000	250, 000	439, 825	81, 000	5, 000, 000	435, 000	657, 640	6, 025	922, 000	160, 000
Total expenditures	71, 321	784, 048	1, 003, 313	536, 596	146, 089	438, 812	80, 000	2, 596, 601	424, 993	656, 242	3, 477	914, 088	159, 297
Balances	4, 844	13, 547	21, 167	38, 404	103, 911	1, 013	1, 000	2, 403, 399	10, 007	1, 398	2, 548	7, 912	703

TABLE 2.—Bureau of Mines expenditures, fiscal year 1945—Continued

Division or branch	Economics of mineral industries	Investigation of raw material resources for steel production	Gaseous and solid fuel reduction of iron ores	Manganese beneficiation pilot plants	Production of alumina from low-grade bauxite, aluminum clays and alunite	Investigation of bauxite and alunite ores and aluminum clay deposits	Magnesium pilot plants and research	Investigation of deposits of critical and essential minerals in the United States and its possessions	Development of processes for recovery of waste materials	Construction and equipment of helium plants	Helium production	Protection of experimental coal-mine property from mine fire	Reduction of zinc concentrates with methane gas
Office of the Director													
Office of Minerals Reports	$7, 893	$19, 309	$98		$5, 011	$568	$1, 334	$30, 141			$145		$26
Total	7, 893	19, 309	98		5, 011	568	1, 334	30, 141			145		26
Administrative Service	38, 025	42, 061	23, 205	$29, 805	25, 902	57, 674	19, 918	55, 581	$193	$11, 927	25, 483		1, 016
Mining and Metallurgical Branch		90, 718	7, 035	12, 105	14, 427	16, 660	8, 587	90, 484					
Central region		917, 810			43, 852	1, 083, 858	2, 122	800, 291					63, 577
Eastern region		987, 683		6, 643	289, 570	229, 486	39, 091	587, 604	58, 237				
Western region		865, 214	207, 460	599, 087	216, 916	67, 614	434, 893	1, 234, 563					
Fuels and Explosives Branch:													
Fuels Division		72, 579						84, 345			2, 230	$23, 567	
Explosives Division													
Petroleum and Natural Gas Division										205, 249	952, 809		
Synthetic Liquid Fuels Division													
Total		72, 579						84, 345		205, 249	955, 039	23, 567	
Economics and Statistics Branch:													
Coal Economics Division	33, 087												
Foreign Minerals Division	76, 581												
Metal Economics Division	226, 605												
Accident Analysis Division	64, 426												
Nonmetals Economics Division	72, 139												
Petroleum Economics Division	52, 691												
Total	525, 529												
Health and Safety Branch:													
Coal Mine Inspection Division													
Safety Division													
Health Division													
Mineral Protection Division													
Explosives Control Division													
Total													
Total appropriations	575, 000	3, 000, 000	250, 000	750, 000	785, 000	1, 543, 000	600, 000	2, 900, 000	59, 648	1, 700, 000	3, 609, 515	43, 978	217, 125
Total expenditures	571, 447	2, 995, 374	237, 798	647, 640	595, 678	1, 455, 860	505, 945	2, 883, 009	58, 430	217, 176	980, 667	23, 567	64, 619
Balances	3, 553	4, 626	12, 202	102, 360	189, 322	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Division or branch	Drainage tunnel, Leadville, Colo.	Experimental plant for synthesis of motor fuel, Pittsburgh, Pa.	Development and operation of helium properties (special fund)	Maintenance Bureau of Ships	Emergency fund for the President, national defense (allotment to Interior, Bureau of Mines)	Emergency fund for the President, national defense (allotment to Interior, Office of Secretary)	Salaries and expenses, Solid Fuels Administration for War	Working funds	Printing and binding	Contingent	Total
Office of the Director	$1,089						$14,271		$82		$45,005
Office of Minerals Reports							11,172		4,941		205,442
Total	1,089						25,443		5,023		250,447
Administrative Service			$2,182				30,550		9,097	$6,178	622,233
Mining and Metallurgical Branch											368,325
Central region									1		3,006,246
Eastern region									2,543		2,588,992
Western region	7,864								3,513		4,285,921
Fuels and Explosives Branch:											
Fuels Division					$465		147,193	$588,849	4,062		1,842,318
Explosives Division								641	1,263		165,613
Petroleum and Natural Gas Division			45,978					43,014	301		2,950,424
Synthetic Liquid Fuels Division											1,433,834
Total			45,978		465		147,193	632,504	5,626		6,392,189
Economics and Statistics Branch:											
Coal Economics Division							778,678		328		812,093
Foreign Minerals Division									50		76,631
Metal Economics Division								85,210	35,355		347,170
Accident Analysis Division							14,527		8,952		104,366
Nonmetals Economics Division									1,240		73,379
Petroleum Economics Division									211		52,902
Total							793,205	85,210	46,136		1,466,541
Health and Safety Branch:											
Coal Mine Inspection Division						$2,376			295		832,491
Safety Division				$14,627				79	7,279		438,450
Health Division											121,569
Mineral Protection Division											133,900
Explosives Control Division									7,574		426,813
Total				14,627		2,376		79	15,148		1,953,223
Total appropriations	21,980	100	433,844	28,000	1,872	5,998	1,011,724	935,506	85,000	6,500	28,988,520
Total expenditures	8,953		48,160	14,627	465	2,376	996,391	717,793	79,513	6,178	20,926,543
Balances	13,027	100	[1] 385,684	13,373	1,407	3,622	15,333	[1] 217,713	5,487	322	8,061,977

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[1] Available for expenditure in fiscal year 1946.

Geological Survey

W. E. WRATHER, *Director*

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THE science of geology, no less than the other sciences, is becoming increasingly important to the Nation's social and economic welfare. The successful application of the principles of geology to the discovery and development of critically needed mineral resources and the successful application of geology for predicting terrain conditions in advance of our military operations represent some of the dividends that were paid to this country during the war as a result of the advancement of geology as a science.

Geology relates to the earth. The better we understand our earth—its composition, structure, and history—the better prepared we are to make the most of the land that we have.

Geological mapping is the mechanism by which our scientists determine the composition, structure, and history of the earth. Reduced to its simplest terms, geologic mapping consists of plotting on a plane map the intersections between the ground surface and the boundary planes that separate different kinds of rocks.

The agency responsible for making geological maps is the Geologic Branch of the Survey, and it plans to undertake extensive, systematic geologic surveys of many large areas of the country. These plans call for the utilization of every known refinement in mapping techniques and for the use of the most modern and varied techniques of geophysical exploration. Indeed, because even these will probably fall short of what should be done, the Survey plans also to carry out rather elaborate research to discover and develop new geophysical and geochemical methods of exploration and to continue and enlarge its research on the geologic and geochemical factors that determine the localization of mineral and mineral-fuel deposits.

The geologic mapping and research will cost something like 4 million dollars annually, for the work of searching hidden geology and determining ore controls is time consuming and costly. But geologic surveys repay their cost to the Nation many times over in augmented mineral wealth and economic benefits. The wartime work of the Geological Survey has already led to the discovery of 25 million dollars worth of new tungsten and mercury ores.

In addition to these domestic plans it is hoped that means can be found to continue and to extend the cooperative scientific work that has been conducted during the war by our Geological Survey and its equivalent agency in various foreign countries. These international projects not only bring mutual scientific benefits but they can become a strong contributing force toward better international understanding.

During the year the Alaskan Branch expended all of its efforts on projects that were carefully selected as being most pertinent to the successful carrying on of the war. The limitations of funds and personnel restricted the work to only a few of the more urgent projects. The projects carried on during the fiscal year were of three general kinds—investigations of deposits of minerals or search for deposits of minerals needed in the war, geologic investigations pertaining to problems of construction or maintenance of military or naval establishments, and planimetric and topographic mapping from aerial photographs.

Projects of the first kind were principally concerned with petroleum, coal, quicksilver, copper, tin, and zinc. Some of the petroleum work was carried on at the request of the Navy Department, and at that Department's expense.

Work of the second type included principally investigation of phenomena associated with permafrost, or permanently frozen ground, that bear directly on construction and maintenance activities over much of Alaska. This work was done at the request and expense of the War Department, and arrangements have recently been completed for continuing these investigations on an expanded scale in the fiscal year 1946. Brief investigation was made for the War Department of a volcano that erupted near an Army establishment in June. The purpose of the study was to determine the extent of danger to the establishment.

Work of the third type was the continuation of the compilation of aeronautical pilotage charts and maps from aerial photographs for the Army Air Forces. This work included the preparation of maps not only of parts of Alaska but of many other areas widely distributed over the world. In order to staff adequately this high-priority work it was necessary to postpone regular Survey planimetric and topographic mapping of Alaska although the need for more maps is continually becoming more acute.

In view of the greatly increased public interest in Alaska and the anticipated development of the Territory in the postwar period, it is planned to refocus the work of the Survey in Alaska to projects pertinent to the Territory.

Topographic mapping in the United States has proceeded at such a slow pace for the past 60 years that only a relatively small part of the country may be considered sufficiently well mapped to meet present-day map requirements. One-half of the Nation is without topographic maps; the other half is provided with maps, but some of these are considered inadequate. This situation is deplorable, and action should be taken at once to make available maps essential to a survey of the natural resources of the Nation.

Topographic maps supply much of the basic data essential to a survey of the country's resources and are highly valuable for the economical and efficient planning of drainage, flood control, irrigation, water supply, hydroelectric and navigation projects; they decrease the number of expensive field surveys usually made in connection with the location of transmission lines, railways, highways, canals, tunnels, airports, and industrial plants and thereby reduce the cost of constructing such projects; they provide topographic data essential to the proper location of frequency-modulated and television radio stations and for recording and correlating data obtained from geologic investigations and thus aid immeasurably in the location, evaluation, and development of our mineral wealth. Maps of this kind provide information essential to the proper classification of the public lands, the conservation of the soil, and the administration and protection of the forests, both national and State. They are of great value for the administration and best utilization of the vast domain of public lands, enormous areas of which have never been mapped and concerning which administrative officials responsible for the enforcement of the public land laws are consequently without adequate knowledge of their extent, the character of the terrain, their intrinsic value, or the possibility of their development.

A comprehensive mapping plan is now being prepared in compliance with instructions from the Secretary of the Interior, under which, if funds are made available by the Congress, the serious handicap of inadequate map information could be overcome within the next 15 years. However, during the past year, as in other years since the beginning of the war, major emphasis has been placed on those operations that contributed directly to the war effort.

The authorized functions of the Geological Survey related to water consist of the collection and publication of information as to the quantity, quality, availability, and utility of the Nation's surface-water and ground-water resources. The quantities of both forms fluctuate widely because they are dependent on precipitation, which may range from 10 inches or less annually in arid regions, to 100 inches or more in humid regions.

Records of the fluctuations in available water are essential to its administration with respect to private, corporate, and governmental users, to interstate relations and compacts, to international problems and treaties, and to its efficient utilization for irrigation, navigation, sanitation, and power, for certain industrial processes, and for many of the comforts of civilized life. As the available supply is inadequate in many places for the many uses that are made of water, the demands for it are conflicting, and pressing questions arise relating to priority of rights, superiority of use, and equitable division. Reliable information is essential to the stability of development, soundness of financing, efficiency of operation, and equity of adjudication and administration. Demands for reliable water information are therefore insistent and continuing. Moreover, information is wanted promptly when it is needed, and little or no time is available for collecting it. Therefore, needs for it must be anticipated and investigations must be started in advance of the probable call for the results.

It is the Survey's policy and duty to collect the essential information as to water resources as rapidly as funds will permit, giving priority to places of probable most urgent need. However, water investigations are largely financed by means of cooperation with States and municipalities, which leads to uneven distribution of investigations among the States. Such financing has the advantage of assurance that investigations will generally be made in those places where the need for them is most pressing, and the disadvantage that little or no provision may be made for starting investigations that will have more specific reference to needs that are not now pressing but will certainly be in the future. In recent years a program of gaging stations and observation wells supported by Federal funds and not dependent on the availability of cooperative State and municipal funds has been inaugurated and gradually developed. This program is, however, still inadequate and is especially weak with respect to observation wells and to the quality of surface waters that have been seriously polluted in places by municipal and industrial wastes during recent years, especially during the war. The Federal program should be continued and expanded. It will serve not only to supplement the cooperative programs but also to provide a net of observation stations, well distributed throughout the country, that will not be liable to breaks resulting from fluctuations in cooperative funds.

The classification of the public lands of the United States as to mineral and water resources and the supervision of operations for the development of these vital natural resources without waste are functions of the Conservation Branch. This work involves intricate problems of geology, engineering, economics, and administration in complying with legislation enacted by the Congress, which contemplates that these resources shall be developed by private initiative in accordance with wise conservation practices. The activities include field investigations and preparation of reports dealing with water power, fuels, minerals, and chemicals essential to national war and postwar programs.

In carrying out the land-classification functions, Government agencies by administrative arrangement are furnished information concerning undeveloped resource values in the form of special reports concerning individual parcels of land involved in applications for sale, lease, exchange, or other forms of disposal. It is an essential service in the proper administration of Federal land in order to insure appropriate and timely use of such property. Advance determination of economic values also assures proper and adequate return for all disposals of such property and compliance with applicable Federal law. In the avoidance of duplication of such essential services by the numerous Federal agencies having need therefor, it is estimated that a saving of not less than 2 million dollars a year is effected in the costs of land administration. Whenever the information so obtained will be useful for the general public in encouraging development of the resources, reports are prepared for public distribution, and local offices are open for consultation by technical personnel employed by private interests. Such services are of indeterminate value to the general public.

The supervision of operations constitutes a technical service which assures use of sound scientific principles in the development of the resources under supervision. The estimated value of production from all public-land mineral resources under supervision has increased from somewhat more than 69 million dollars in 1935, to a present annual worth of nearly 150 million dollars, and during the same period royalty accruals have increased from 6.75 to 11.64 million dollars a year. The oil, gas, coal, lead, zinc, and other mineral resources under leases supervised by the Branch have a value estimated in excess of 2 billion dollars.

It is expected that discoveries of new deposits during the postwar years will increase the known reserves materially. Proper engineering practices will increase the ultimate economic value of these, probably not less than 50 percent.

GEOLOGIC BRANCH

The Geological Survey is, in a sense, custodian and appraiser of the Nation's mineral wealth. How great that wealth is may be judged from the fact that the aggregate value of all the mineral and mineral-fuel resources produced in the United States up to the end of 1943 was approximately 8 billion dollars. The reserves in the ground that are now known or are being worked are estimated to be worth more than 6 trillion dollars and to that must be added all the yet undiscovered mineral wealth. Until a vast amount of geologic and geophysical investigation and research are done no one can give even a "guesstimate" of the probable value of these total resources. Suffice it to say that 6 trillion dollars plus another large but unknown amount is staggeringly huge. More than 90 percent of this huge value, however, is locked up in our colossal coal reserves. In other fuels and most metals we are much less well off.

In meeting the requirements for war our Nation has taken a heavy toll of its mineral resources. Of our known commercial reserves, we have depleted 97 percent of our mercury, 78 percent of our chromium, 70 percent of our vanadium, and comparable amounts of manganese, tungsten, zinc, and copper. Our fluorspar resources are being depleted four or five times as fast as in normal times, and peacetime adaptations of wartime uses will cause heavy demands after the war. War requirements have strained available resources of petroleum to the limit, and in some pools reserves in the ground have been endangered by too heavy withdrawals.

Discovery of new deposits can counter this depletion but because the easily discoverable deposits have already been extensively exploited, it will be necessary to expand old techniques of exploration and to develop new ones capable of finding obscure and deeply hidden deposits that have no easily discernible surface manifestations.

Geologic mapping is the first need in the search for hidden deposits of minerals. As the search becomes more intense and more difficult larger-scale geologic surveys are required. At the present time not more than 7 percent of the United States has been mapped geologically on scales adequate to serve the modern discovery program necessary to sustain our industries.

The Geological Survey plans to undertake extensive and systematic geologic surveys of many large areas of the country. These plans call for the utilization of every known refinement in mapping techniques and for the use of the most modern and varied techniques of geophysical exploration. Indeed, because even these will probably fall short of what should be done the Survey plans also to carry out rather elaborate research to discover and develop new geophysical and geochemical methods of exploration and to continue and enlarge its research on the geologic and geochemical factors that determine the localization of mineral and mineral-fuel deposits. Some of the techniques and methods developed by the unit will be of great value in the planning and construction of peacetime engineering projects, such as the selection of airport sites, highway alinements, dam construction, and municipal planning and development. Any large-scale construction project necessarily must be adapted to the geological and soil conditions at the site.

The limit of the Nation's capacity to produce oil efficiently from known fields was reached during the war, and forecasts for the postwar years indicate even greater requirements. This emphasizes the necessity for an accelerated rate of discovery. Geologic investigations directed toward this end have been conducted vigorously, and success in finding new sources of petroleum is confidently expected. Nevertheless, prudence demands that we appraise the potentialities of substitutes for liquid petroleum. The oil shales and the low-rank coals, especially those of the Rocky Mountain States, afford a source of substitutes in large quantity, and extensive field investigations of them should be undertaken now.

Expansion and redistribution of industry during the war has created local problems of coal supply requiring special investigations. One of the most pressing of these problems concerns the need for supplies of coking coal to sustain the new steel industry of the Salt Lake Valley, Utah, and of the Pacific coast.

Geologic maps pay extra dividends in appraising surface and underground water resources, in making soil surveys, in planning intelligent soil-conservation programs, and in the planning and execution of large engineering construction projects and reclamation programs.

During 1945 the work of the Geologic Branch was devoted strictly to war projects.

The Military Geology unit, at the request of the Military Intelligence Division, Office of the Chief of Engineers, expanded its terrain studies and also filled requests for more than 50 geologists to be detailed to the theaters of operation on assignments concerned with the preparation of operational intelligence or as scientific consultants in combat zones. Numerous official commendations prove the value of applying scientific methods for predicting terrain conditions in advance of operations.

New sources have been sought for certain rare elements that were needed for secret war projects like the atomic bomb. In addition to extensive field studies new techniques, both for field and laboratory use, have been developed to aid the discovery program. This part of our work is receiving much attention because of the tremendous peacetime implications of harnessing atomic power.

Our work on metallic minerals has emphasized basic geologic studies of the principal ore-producing districts in order to provide a proper foundation for further exploration. Some of this effort has already produced results: At San Manuel, Ariz., the Geological Survey cooperated with the Bureau of Mines in a drilling program that indicated copper reserves of possibly as much as 64 million tons of ore averaging 0.8 to 0.9 percent of copper, which is a small fraction of a percent below the 1.0 to 1.1 percent copper ores worked in large volumes in Utah and Arizona. About 10 million tons of bauxite ore have been added to the known national reserves of about 75 million tons as a result of investigations conducted jointly during the past 4 years by the Geological Survey and Bureau of Mines.

Under the auspices of the State Department and the Interdepartmental Committee for Cultural and Scientific Cooperation, 13 mineral commodities were investigated cooperatively in Mexico, Cuba, Chile, Brazil, the Dominican Republic, and Haiti. The Geological Survey frequently in the past has been host to representatives of foreign Geological Surveys who have visited this country. More attention should be given to the cultural and scientific benefits that accrue from the visits of foreign scientists here and the visits of our scientists to foreign countries.

ALASKAN BRANCH

During the year the geologic work of the Alaskan Branch was devoted to projects that seemed to promise immediate results in terms of satisfying the war needs of the Nation for certain mineral commodities and supplying direct benefits to the war agencies engaged in activities in Alaska. The intense search for and examination of Alaskan mineral deposits during the war has clearly demonstrated the need for continuing in the postwar period the making of an adequate inventory of Alaska's mineral resources.

The war years have seen a greatly increased public interest in Alaska. The Alaskan Branch in its activities has reflected this interest, and its expanded and pointed war program has illustrated the sound basis for such interest. The field investigations of the twoscore members of its technical staff, during the short seasons imposed by climatic conditions, have resulted in the issuance of a series of reports covering detailed examinations of a large number of mineral deposits, some whose worth was previously undetermined, others whose very existence was uncertain. While few of these deposits have as yet reached the stage of commercial development many stand available as sources of added raw materials should our country face greater or long-continued needs for such mineral commodities. As a result of these relatively limited studies the reserves of many of the war minerals present in the Territory have been substantially increased. For example, quicksilver, formerly considered as a resource of only minor significance, has become one of the important commodities which are now commercially produced in Alaska. The work of the Alaskan Branch geologists has increased known coal reserves by millions of tons. The mining of gold, in peacetime Alaska's major mineral industry, has been seriously curtailed by the war.

Not only has no significant percentage of Alaska's mineral resources been consumed in our war effort, but her mineral wealth is still so slightly tapped that any calculation in terms of dollars and tonnage reserves can be only a rough approximation. The Alaskan Branch, which has never numbered more than 40 geologists and through most of the half century of its life has numbered between 5 and 10 men, has spread its efforts widely over most of Alaska's nearly 600,000 square miles and has accumulated a considerably body of sound and lasting information, but the task ahead is tremendous. As a result of these activities the known value of Alaska's mineral resources can be set at a minimum of several billions of dollars.

The accelerated war program has been coordinated with the anticipated future development of the Territory. Many of the thousands of servicemen who have passed through or have been stationed in Alaska have become greatly attracted to the Territory. Never again will there be a lack of interest in the Territory. With the growing interest in Alaska are coming increased inquiries as to the possibilities there for newcomers. Information as to Alaska's mineral resources is sought daily from the Alaskan Branch by servicemen, other private citizens, and corporations. As a result of its war program the Branch is better able to reply adequately to such questions than at any time in the past. But to provide complete answers to many of these questions, answers which will enable the questioner to plan his new life satisfactorily, far more is needed. The average postwar settler in Alaska can be helped immeasurably and the development of the Territory on a sound basis expedited if the Alaskan Branch and other Government agencies, each in its respective field, are able to supply the needed answers.

Alaska's development must be based on a sound and enduring economic structure, which has been established with an understanding of the aims and methods of sound conservation, not only for the safeguarding of Alaska's resources for the future but as well to insure the success of its prospective citizens in their varied ventures. One of the prime requisites for the establishment and maintenance of a highly developed civilization is the production and regular revision of a series of large-scale topographic maps of high detail and accuracy. The most efficient development of any area is impossible without the careful study of such maps. The most desirable locations for town sites, highways, reservoirs, airports, and a myriad of other works of man require at least initially a careful examination of detailed topographic maps. As a result of its work for the Army Air Forces, small-scale aeronautical pilotage charts have been completed by the Branch for the greater part of the Territory, but these, while they will serve as a springboard for future mapping activity, are inadequate to meet the demands of a developing civilization. Less than 1 percent of Alaska has been mapped in the detail and accuracy considered essential for areas of only moderate development in the United States.

With the production of such detailed maps should come a greater intensification of diversified geological examinations. Before the war the emphasis was placed on investigations contributory to the production of gold, during the war it was placed on the development of minerals essential to the war program, and now the postwar emphasis must be on a diversified mineral production. The development of deposits of nonmetallic mineral commodities, such as limestone, gypsum, marble, and other building stones, and clay, gravel, and sand may make important contributions to the establishment of a sound and stable society in Alaska. Alaska's fuels, her coal and perhaps her petroleum, may prove sufficient when adequately developed to satisfy not only her own needs but to sustain a considerable "export" trade as well. Many of these materials or their finished products are being shipped to Alaska today when Alaskan reserves, as yet practically undented, may be able to offer the same or better materials with lower costs and greater efficiency. Along with its postwar development of such mineral resources the Branch must continue at an increased tempo the delimitation of areas in which the production of metallic minerals is, or may become, possible. It is the duty of the Alaskan Branch to provide the basic information necessary for the continuation, expansion, and greater diversification of Alaska's mineral industry.

During the field season of 1944, which included the latter part of the fiscal year 1944 and the early part of the fiscal year 1945, the Alaskan Branch, through its regularly appropriated funds, carried out 15 specific projects and 4 supervisory projects, the majority of which were devoted to petroleum, coal, quicksilver, copper, tin, and zinc investigations.

The program for the field season of 1945 has been influenced in compliance with the needs of certain units of the War and Navy Departments. In the latter part of the fiscal year 1945 about two-thirds of the technical geologic personnel of the Alaskan Branch of the Geological Survey were engaged on projects designed to meet these needs. In addition six projects relating to mineral commodities for which there was an acute demand to meet war needs were in progress at the close of the fiscal year 1945.

A major activity of the Alaskan Branch throughout the fiscal year has continued to be the compilation of aeronautical pilotage maps and charts from photographs furnished by the Army Air Forces, and financed with funds transferred to the Geological Survey from the Air Forces.

During the 1945 fiscal year 3 bulletins were published, 8 preliminary mimeographed reports on strategic and critical mineral investigations, 7 press releases embodying technical information and designed to take the place of preliminary reports pending regular printing of the results, 1 geologic and topographic map accompanied by a brief report, and 12 other press releases were issued.

TOPOGRAPHIC BRANCH

The headquarters offices of the Topographic Branch and the Atlantic Division are in Washington, D. C.; the headquarters office of the Central Division is in Rolla, Mo.; and that of the Pacific

Division is in Sacramento, Calif. Section offices are maintained in Chattanooga, Tenn., and Arlington, Va.

General Office Work

The major part of the year's activities of the Topographic Branch was directed toward producing maps in manuscript form from aerial photographs made for the War Department. Approximately 80 percent of the time and services of the personnel of the Arlington, Va., and Chattanooga, Tenn., groups was devoted to the mapping or supervision of mapping of areas in foreign countries for use of the Armed Forces. In all, 64,084 square miles were mapped by these facilities, of which 59,810 square miles were completed before VE-day.

Of the domestic maps published during the year, 183 were within the strategic areas designated by the War Department, thus increasing to 586 maps the total published of those areas since the declaration of war.

Section of computing.—Processing field notes of geodetic control surveys is the primary function of this section. The listed results are required by topographers and geologists in subsequent mapping processes of the Geological Survey. They are furnished regularly to the War Department, and, upon request, to other governmental organizations. As a public service, data for limited areas are available to geophysical prospectors, civil engineers, and surveyors throughout the United States. During the year lists for 374 quadrangle-map areas were issued in lithographed form, and many others were prepared as typewritten manuscript.

The section is engaged in occasional tests of field instruments and researches into computing methods. Instructions are prepared for the technical procedures used in both field work and office processing of leveling, transit traverse, and triangulation.

Section of photomapping.—The principal work of this section is the production of topographic maps from aerial photographs by stereophotogrammetric methods and the production of planimetric maps and planimetric bases for topographic field surveys by both stereophotogrammetric and graphic methods.

Topographic maps of areas in the United States produced during the year by these methods covered approximately 6,280 square miles; planimetric and base maps covered an area of approximately 8,688 square miles. Topographic maps of foreign areas were produced in manuscript form from aerial photographs for the War Department of an area of approximately 35,734 square miles. In addition, Geological Survey personnel working in cooperation with the Tennessee Valley Authority either completed or supervised additional foreign mapping for the War Department in the amount of 28,350 square miles.

At the principal office of the section, in Arlington, Va., in addition to the large production facilities, which are operating on a two-shift basis, there are also maintained a central laboratory for designing, testing, repairing, and adjusting all types of special optical and mechanical equipment utilized for stereophotogrammetric work and a photographic laboratory specializing on research and precision photography required for the other offices.

The Washington office maintains a general file of aerial photographs utilized in the work of the Geological Survey and of aerial photographic negatives that have been purchased under photographic contracts. Through this office contacts are maintained with other governmental agencies involved in aerial photographic work.

Section of cartography.—Work on the International Map of the World on a scale of 1:1,000,000 was continued. Sheets H–14 (Austin); H–15 (Mississippi Delta); I–17 (Savannah); I–18 (Hatteras); (K–10 (Mount Shasta); K–17 (Lake Erie); and L–10 (Cascade Range) were in progress, and sheet K–16 (Chicago) was in course of publication at the end of the year.

The preparation of the transportation map for the Public Roads Administration was continued. Compiling, inking, lettering, and editing was in progress for the States of Louisiana, Nevada, North Carolina, Ohio, and West Virginia. Fourteen sheets in New Mexico were published; 33 sheets in Texas are in course of publication; and 8 sheets in North Carolina were transmitted for publication.

The Columbia River Basin maps for the International Columbia River Engineering Board as well as other special maps were prepared for publication.

Section of inspection and editing.—During the year 249 quadrangle maps were edited for publication, 175 of which were for multicolor photolithography and 74 for engraving; 376 quadrangle maps, 15 State maps, and 10 State index maps were prepared and edited for reprint editions; 112 maps and diagrams that had been prepared as illustrations for geologic reports were edited; and 392 proofs of all kinds were read. On June 30 maps in the process of reproduction included 85 for engraving and 79 for multicolor photolithography; maps being edited or awaiting editing included 32 maps for engraving and 59 for multicolor photolithography; and 292 maps remained on hand for preparation for reprinting.

The Section of Inspection and Editing maintains in Arlington, Va., a small unit to draft maps produced by the Atlantic Division.

Map Information Office

The Map Information Office continued its work as clearing agency for data pertaining to maps and aerial photographs of both Federal and commercial agencies. The office maintains extensive card-index and map files and is equipped to furnish data to Federal and State institutions and to the public.

Field Surveys

Topographic mapping was carried on in 35 States. Cooperative projects were conducted with 19 States and with the Tennessee Valley Authority.

Topographic mapping by the Geological Survey in the United States, Puerto Rico, and Hawaii, to June 30, 1945

State	Area mapped during fiscal year 1945 for publication on standard scales, contour intervals from 1 to 50 feet (square miles)				Total area mapped to June 30, 1945 (square miles)	Percentage of total area of State mapped to June 30, 1945	Control, fiscal year 1945		
	Field scale		New survey	Resurvey			Spirit levels (miles)	Transit traverse (miles)	Triangulation stations established
	1 to 24,000 or larger	1 to 48,000							
Alabama		194	194		26, 078	50. 5	344		
Arizona		325	123	202	33, 521	29. 4			9
Arkansas	265		16	249	24, 630	46. 3		39	
California		716	226	490	132, 630	83. 6	280	48	14
Colorado	332		109	223	58, 265	55. 9	118		26
Connecticut	71			71	5, 009	100. 0			
Delaware					2, 057	100. 0			
District of Columbia					69	100. 0			
Florida					11, 949	20. 4			
Georgia	55			55	25, 202	42. 8		92	
Idaho	6		6		37, 629	45. 0	115		20
Illinois	111	708	819		45, 837	81. 3	81	289	
Indiana	395		395		8, 184	22. 6	124	74	
Iowa					14, 233	25. 3			
Kansas	2	221		223	65, 852	80. 0	68	11	29
Kentucky					27, 559	68. 2			
Louisiana		1, 043	1, 043		18, 585	38. 3	31	42	
Maine		605		605	25, 977	78. 2			
Maryland					10, 577	100. 0			2
Massachusetts	656			656	8, 257	100. 0			
Michigan	455	506	527	434	17, 077	29. 3	167	164	
Minnesota					9, 542	11. 4			
Mississippi					8, 997	18. 9			
Missouri	52	1, 717	1, 256	513	62, 783	90. 1			
Montana	27	402	429		39, 741	27. 0	55		
Nebraska					28, 225	36. 5			
Nevada		219	219		43, 981	39. 8	328		54
New Hampshire					9, 304	100. 0			
New Jersey					7, 836	100. 0			
New Mexico	15	505	520		36, 676	30. 1	75	38	27
New York	613	22		635	49, 576	100. 0			
North Carolina					19, 574	37. 1			
North Dakota		507	507		17, 335	24. 5	102	114	
Ohio					41, 222	100. 0			
Oklahoma	68	245	313		41, 899	59. 9	15	42	12
Oregon		438	438		36, 119	37. 2	103		13
Pennsylvania	899		640	259	43, 563	96. 1			
Rhode Island					1, 214	100. 0			
South Carolina					15, 772	50. 8			
South Dakota					20, 750	26. 9			
Tennessee	105			105	23, 998	56. 8			
Texas		204	204		92, 736	34. 7		1	
Utah		109	109		20, 228	23. 8	205		41
Vermont	194	79	79	194	9, 365	97. 5			
Virginia		413		413	38, 097	93. 3	245	276	
Washington		275	228	47	44, 403	65. 1	77		27
West Virginia		32		32	24, 181	100. 0			
Wisconsin		[1]			20, 348	36. 2		249	
Wyoming	48	128	176		35, 818	36. 6	101		27
Total or average	4,369	9, 613	8, 576	5, 406	1, 442, 460	47. 7	2, 634	1, 479	301
Hawaii					6, 435	100. 0			
Puerto Rico					3, 370	98. 8			

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[1] Planimetric maps covering 1,638 square miles in Wisconsin, not included in total surveys, were compiled from aerial photographs with field examination.

The mapping of forty-three 15-minute quadrangles and ninety-six 7½-minute quadrangles was completed and mapping was in progress on forty-two 15-minute quadrangles and thirty-nine 7½-minute quadrangles at the end of the year. In addition, work on 132 quadrangles was progressing in some one of the steps prior to actual mapping. Of the 139 quadrangles completed and the 81 partly completed, 116 are within the strategic area designated by the War Department. For use in the investigation of strategic and critical minerals, including iron, copper, bauxite, alunite, high-aluminum clay, manganese, and zinc, 9 special projects were completed and 1 was in progress.

Mapping was accomplished on 16 projects in several States for the Army Engineers, War Department, for flood control. For the irrigation and reclamation of lands, 5 large-scale maps were in progress for the Bureau of Reclamation. The survey of the Olympic National Park in the State of Washington was continued.

Of the total area of the United States, 47.7 percent has now been covered by topographic maps produced by the Geological Survey.

WATER RESOURCES BRANCH

The Water Resources Branch collects and publishes basic information on the conditions and uses of surface water and ground water in all parts of the country. A widely scattered field force is needed for this work. About 100 field headquarters are maintained in which experienced men familiar with local problems related to water are available. Such decentralization serves well the purposes of cooperation, as close contact is thereby maintained between the Survey personnel and cooperating State and municipal officials, and information is available currently where urgently needed. During the emergency of war and now in preparing for peace the decentralization of the Survey's field forces has been especially valuable, because men who are specialists not only in water problems but also in local problems have been available in all parts of the country to conduct special field investigations and to furnish information promptly and efficiently.

Cooperation With States and Municipalities

States and municipalities provided more than a third of the funds for the Survey's water investigations during the fiscal year 1945. The amounts contributed for cooperation in each State are summarized below:

State:	*Contribution*
Alabama	$15, 000
Arizona	30, 900
Arkansas	11, 250
California	90, 730
Colorado	32, 550
Connecticut	11, 430
Delaware	2, 050
Florida	40, 620
Georgia	17, 200
Idaho	28, 050
Illinois	15, 090
Indiana	26, 400
Iowa	27, 745
Kansas	35, 540
Kentucky	25, 900
Louisiana	31, 750
Maine	7, 500
Maryland	16, 975
Massachusetts	17, 246
Michigan	31, 375
Minnesota	15, 790
Mississippi	15, 000
Missouri	13, 055
Montana	13, 810
Nebraska	27, 520
Nevada	10, 000
State—Continued	
New Hampshire	$9, 208
New Jersey	23, 550
New Mexico	41, 850
New York	83, 378
North Carolina	24, 500
North Dakota	13, 900
Ohio	29, 751
Oklahoma	26, 130
Oregon	26, 075
Pennsylvania	41, 800
Rhode Island	2, 950
South Carolina	9, 050
South Dakota	4, 550
Tennessee	22, 100
Texas	64, 300
Utah	25, 906
Vermont	6, 260
Virginia	33, 800
Washington	55, 587
West Virginia	9, 300
Wisconsin	9, 388
Wyoming	21, 200
Hawaii	43, 947
Total	1, 238, 956

Activities Carried on for Other Federal Agencies

Other Federal agencies provided about $970,000 for water investigations that could not be financed by appropriated funds of the Geological Survey or included in cooperative programs. These agencies are the Office of the Chief of Engineers and the Mississippi River Commission, War Department; Bureau of Yards and Docks, Navy Department; Tennessee Valley Authority; Weather Bureau, Department of Commerce; Bureau of Reclamation, Fish and Wildlife Service, National Park Service, Office of Indian Affairs, Office of Land Utilization, and Bonneville Power Administration, Department of the Interior; Department of State; Defense Plant Corporation; Federal Power Commission; Federal Works Agency; War Production Board; Foreign Economic Administration; and Bureau of Prisons, Department of Justice.

War and Postwar Activities

Throughout the war the Geological Survey operated in an unusual degree as a consulting agency on matters related to the availability and chemical quality of water for war activities of all kinds. This service was based on the Survey's collection of essential facts gathered over many years by means of both regular and special programs of investigation.

During the 4 years, July 1, 1941, to June 30, 1945, the Geological Survey made more than 15,000 special reports on water at the request of war agencies. Of these, 4,225 were made in the fiscal year 1945. There is no basis for exact estimates of the value of these reports. Many of them have given assurance of the adequacy of available water supplies and so have led to sound and efficient developments; adverse reports have prevented unwise development and waste of money in inefficient or useless construction. Some of the reports have certainly been worth many hundreds of thousands or even millions of dollars; others may have been worth not more than $50, but assuming conservatively an average value of $1,000 each, the over-all value of the 15,000 special reports has been at least 10 to 20 million dollars.

Other significant values of the service of the Geological Survey in relation to water are indicated by the fact that Federal agencies have for several years transferred to the Geological Survey nearly $1,000,000 annually for special water investigations made in addition to the continuing programs conducted in cooperation with States and municipalities. No estimate has been attempted of the great value to private and corporate industry and to the general public. The values of water facts during the years of war are illustrative of even greater values in the many years of peace, when supplies will be more fully utilized and need for knowledge of them becomes more critical.

Continuing Activities

The operations of the Water Resources Branch have been conducted by five administrative divisions—surface water, ground water, quality of water, utilization of water, and power resources.

Records of the stage, quantity, and availability of surface waters are collected through 65 field offices at about 5,600 gaging stations distributed through every State and Hawaii, the number of stations depending largely upon the funds made available by 166 cooperating State and municipal agencies and by transfer from other Federal agencies.

The investigations of ground water relate to the water from which wells and springs are supplied. Investigations in nearly every State and Hawaii are conducted through 38 field offices and in cooperation with 74 State and municipal agencies. During the year, periodic measurements of water levels or artesian pressure were made in about 7,000 observation wells. Observations were continued to determine the depletion caused by the numerous war industries and other war establishments and to provide against possible shortages. Attention was also given to natural and artificial replenishment of the ground-water supplies, and to their maximum utilization for the many prospective postwar demands. The war has caused heavy overdrafts on ground-water storage at many places. Data are not available for computing this overdraft exactly, but it may be as much as a few hundred billion gallons.

Chemical analyses of 2,048 samples of water were made in the Water Resources laboratory in Washington, and analyses of 4,867 samples were made in laboratories in Safford, Ariz.; Albuquerque, N. Mex.; Raleigh, N. C.; Stillwater, Okla.; and Austin, Tex. Many samples were collected in connection with studies of water supplies for Army and Navy establishments and for munition plants and housing developments. Cooperative studies of the chemical character of surface waters were started in Pennsylvania and Virginia and were continued in Florida, Georgia, Louisiana, New Mexico, North Carolina, and Texas. Samples were analyzed for cooperative studies of ground waters in other States. Interpretations of analyses or advice about water problems were furnished to other Federal departments and to independent agencies.

A variety of hydrologic and hydraulic studies and compilations were made on the utilization and control of streams, and the Water Resources Review, a monthly summary of stream-flow and ground-water conditions in this country and Canada was issued. The administration of certain features of permits and licenses of the Federal Power Commission has been continued. Investigations of water problems along the international boundary between the United States and Canada have been continued for the State Department and the International Joint Commission. After the death of A. H. Horton, for many years its Chief, the Division of Power Resources was discontinued as of March 31, 1945, and its functions transferred to the Division of Water Utilization.

CONSERVATION BRANCH

The classification of the public lands of the United States as to mineral and water resources and the supervision of operations for the development of these vital natural resources without waste are functions of the Conservation Branch. This work involves intricate problems of geology, engineering, economics, and administration in complying with legislation enacted by the Congress, which contemplates that these resources shall be developed by private initiative in accordance with wise conservation practices. The activities include field investigations and preparation of reports dealing with water power, fuels, minerals, and chemicals essential to national war and postwar programs.

Classification of Lands

Mineral classification.—The Mineral Classification Division, in response to war-engendered demand for new sources of oil, gas, coal, potassium, and magnesium from the public domain, continued and increased markedly all phases of its service during 1945.

In all, 13,079 cases were acted on during the year, an increase of 20 percent over 1944. Initial or revised definitions of the known geologic structure of 7 producing oil or gas fields were prepared and promulgated; geologic appraisal was made of 80 unit-plan submissions; and 53 special reports were rendered to the General Land Office on new discoveries of oil or gas on or adjacent to Federal lands, including 22 applications for the royalty benefits accorded by the act approved December 24, 1942 (56 Stat. 1080), for the discovery of new oil and gas fields or deposits during the national war emergency.

The Division established during the year a sixth regional field office with a resident geologist in charge at Tulsa, Okla.

Water and power classification.—The work of obtaining basic information concerning the water-power resources and storage possibilities of Federal lands was on projects proposed for development to assist in the prosecution of the war or for postwar construction. Topographic surveys were made of 147 linear miles of streams including 8 dam sites. In cooperation with the Water Resources Branch, supervision of construction and operation was given to 163 power projects under license from the Federal Power Commission, to 212 such projects under permit and grant from the Department of the Interior, and to 157 in cooperation with the Office of Indian Affairs.

Office activity resulted in the addition of 110,278 acres to powersite reserves and the elimination of 7,929 acres, increasing the outstanding reserves in 22 States and Alaska to a net total of 6,774,297 acres; in the publication of maps of 180 miles of stream valley and 18 dam sites; in final action involving hydraulic determination on 267 cases received for report from departmental sources and the Federal Power Commission, and in water-power classification on 1,939 cases, which also involved mineral classification. Reservoir-site reserves in 9 States remain unchanged at 137,172 acres.

Mineral Lease Supervision

Mine supervision.—The Mining Division supervises operations for the discovery and production of coal, potash, phosphate, sodium, silica sand, sulfur, and oil shale on public lands; of gold, silver, mercury, and quartz on various land grants; and of all minerals except oil and gas on tribal and restricted allotted Indian lands. The total output of such minerals from Indian and public land was valued at more than $66,000,000 during 1945. The Division serves as consultant to the Department of Agriculture on mining leases under the jurisdiction of that Department and also supervises production of minerals from public lands by the Metals Reserve and the Defense Plant Corporation. The supervisory work involved on June 30, 1945, 572 public-land properties under lease, permit, and license; 235 Indian properties under lease or permit in 14 States and Alaska; and 3 secretarial authorizations in 3 States.

The Division cooperated with the Departments of War, Justice, and Agriculture, other bureaus of the Department of the Interior, the War Production Board, the Reconstruction Finance Corporation, the Defense Plant Corporation, and Smaller War Plants Corporation by furnishing information on potential sources of minerals necessary to the successful prosecution of the war.

The production of potash was maintained at a high level during the year, with continued diminution of known high-grade ore reserves on public lands in New Mexico. Test holes drilled cooperatively by the Geological Survey and the Bureau of Mines in and adjacent to the potash reserve created by Executive Order 6797 indicated that the reserve contains several million tons of high-grade potash ore. Prospect drilling by the three large operating companies in advance of mine development disclosed additional high-grade reserves.

The increasing demand for fertilizer materials, because of the need for increased food production, has intensified interest in the development of phosphate deposits in the western States. During the year one phosphate lease was modified to include additional land and production was begun under two leases previously issued. The suspension of action on the issuance of phosphate leases by Departmental Order 1294, of July 2, 1938, except in particularly meritorious cases, continues in force.

Most of the sodium from the public domain is produced from Searles Lake, Calif., the plants there being operated at maximum capacity, with available labor, to meet the war-induced demand for chemical products used in the manufacture of war materials, such as percussion caps, bombs, flares, shells, smokeless powder, synthetic rubber, armor plate, range finders, bomb sights, and fire-control apparatus. Sodium products are used also as food preservers, water softeners, and refining processes.

Oil and gas supervision.—The Oil and Gas Leasing Division supervises operations for the discovery and production of petroleum, natural gas, natural gasoline, and butane occurring in public lands of the United States, in naval petroleum reserves, and in all Indian lands subject to departmental jurisdiction, both tribal and allotted, except those of the Osage Nation, in Oklahoma. During the year these duties were accomplished through 18 field offices and suboffices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

Four special-study groups were engaged in investigations to aid in secondary recovery operations and other engineering practices necessary to conservation and maximum ultimate recovery of petroleum from public-land leases. During the year studies were completed and preliminary reports prepared on the Buena Vista Front Pool, Calif.; Square Lake and Grayburg fields, N. Mex.; Cole Creek and South Oregon Basin fields, Wyo. A limited supply of mimeographed copies of reports for the Hogshooter and Nowata-Claggett fields in Oklahoma was prepared for public distribution.

On public lands, 7,041 oil and gas properties were under supervision at the end of the fiscal year, aggregating 4,596,053 acres in 20 States and Alaska, an increase of 32 percent in the number of properties and nearly 48 percent in the acreage under supervision at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 566 wells and the completion of 626 wells, 440 of which were productive of oil and gas and 186 of which were barren. In all, 11,460 public-land wells, including 6,289 capable of oil and gas production, were under supervision on June 30, 1945. The production from petroleum deposits of the public lands during 1945 was somewhat more than in 1944.

The efforts to fulfill the need for new petroleum reserves were reflected in an increase of 4 in the number of new unit plans approved during the year, the total being 22; 11 unit plans were terminated because all rights thereunder were relinquished or abandoned, leaving 121 approved plans covering 1,421,487 acres outstanding on June 30, 1945. Production under approved unit agreements constituted about 54 percent of the petroleum obtained from public lands during the year, 71 percent of the natural gas, and 80 percent of the gasoline and butane. In addition, two Indian-land unit agreements covering a gross area of 11,685 acres were in effect during the year.

On Indian lands the work of oil and gas lease supervision involved 4,786 leaseholds in 9 States, containing at the end of the year a total of 7,569 wells, 3,987 of which were productive of oil or gas and 146 of which had been completed during the year. Notable increases in production of natural gas and crude oil were reported from the Chickasaw and Choctaw lands in Oklahoma, from the Blackfeet lands in Montana, and from the Shoshone lands in Wyoming. Rentals, royalties, and bonuses accrued from Indian-land operations during the fiscal year are estimated to aggregate $3,073,728.

On behalf of the Navy Department supervision was continued over operations for the production of oil, gas, gasoline, and butane from 31 properties under lease in Naval Petroleum Reserves Nos. 1 and 2 in California. Production from 312 active wells on this reserve aggregated 3,284,300 barrels of petroleum, 3,584,300,000 cubic feet of natural gas, and 8,343,300 gallons of natural gasoline and butane, having an aggregate royalty value of $600,200.

WORK ON PUBLICATIONS

Texts.—The publications in the regular series (professional papers, bulletins, and water-supply papers) issued during the year numbered 38, a decrease from the 49 of last year, again reflecting adjustment to a war-curtailed publication schedule. These publications together with 18 miscellaneous publications issued during the year comprise 7,289 printed pages. Work by the editors included: 6,671 pages of manuscript edited and prepared for printing; 431 galley proofs and 2,955 page proofs revised and returned; indexes prepared for 4 publications, covering 632 pages and consisting of 593 index entries. Copy prepared for mimeographing included 92 press releases, consisting of 147 pages, and 76 pages of miscellaneous material.

Illustrations.—Seventeen reports, containing 403 illustrations, were transmitted to the printer. In addition, 37 maps and sections illustrating deposits of essential strategic minerals were prepared for preliminary release, and 210 proofs and 39 edition prints were examined.

Geologic map editing.—Sixty-five geologic maps and diagrams were completed by the new Section of Geologic Cartography, including multicolor maps of the Comstock Lode district, Nev., and the Gouverneur talc deposits in New York. Copy for the geologic map of Idaho was nearly completed, and the Hollidaysburg-Huntingdon folio was finished. Progress was made on the geologic map of the District of Columbia and vicinity and on the preparation of indexes showing published geologic information on each of the 48 States.

In addition to the maps prepared by the Section of Geologic Cartography, the geologic map editor examined and checked 63 maps and figures drafted by the Section of Illustrations for water-supply papers and 70 maps and figures for professional papers and bulletins.

Distribution.—The Division of Distribution received during the year a total of 852 publications, comprising 40 new books and pamphlets and one special reprint of Water-Supply Paper 888 for official use only, 35 preliminary maps and 9 preliminary charts in the oil and gas and war-minerals investigation series, 253 new or revised topographic and other maps, of which 30 maps were first published as preliminary editions, one Tennessee Valley Authority map with contours, 474 reprinted topographic and other maps, and 9 reprinted advance sheets. The total units of all publications received numbered 74,226 books and pamphlets, plus 1,000 copies of the reprint, 14,500 copies of revised index maps, and 2,308,005 topographic and other maps, a grand total of 2,396,731. The division distributed 72,154 books and pamphlets, 722 geologic folios, and 1,155,548 maps, making a grand total of 1,228,424, of which 678 folios and 1,001,194 maps were sold. The net proceeds (gross collections less copying fees and amounts refunded) from the sales of publications were $56,608.20, including $56,425 for topographic and geologic maps and $183.20 for geologic folios. In addition to this, $20,923.59 was repaid by other establishments of the Federal Government at whose request maps or folios were furnished. The total net receipts, therefore, were $77,531.79.

Division of map reproduction.—During the year 80 newly engraved topographic maps, 161 multicolor topographic maps, 44 geologic preliminary maps, and 12 special maps were printed, making a total of 297 new maps printed and delivered. Reprint editions of 393 engraved topographic maps, 8 multicolor maps, and 73 photolithographed State geologic and preliminary and other maps were printed and delivered. Of new and reprinted maps, 771 different editions, amounting to 2,322,779 copies, were delivered. A large amount of work was done for 69 other units of the Government, including branches of the Geological Survey and States, and the charges for it amounted to about $177,000, for which the appropriation for engraving and printing geologic and topographic maps was reimbursed. Transfer impressions and velox prints, numbering 61, were made during the year, and the amount turned over to miscellaneous receipts was $1,129.10. Topographic maps and contract and miscellaneous work of all kinds, totaling 4,776,814 copies, were printed and delivered. The photographic laboratory made 9,647 negatives, 28,673 prints, 3,872 photolith press plates, 238 intaglio etchings, 2 celluloid transfers, and mounted 1,448 prints.

LIBRARY

The work of the library during the year was again directed principally toward providing reference material for the war activities of the Geological Survey. The Military Geology unit with a corps of bibliographic aids used the library to the maximum in making a compilation of strategic engineering studies. The total number of readers was 12,000. The total circulation of books, pamphlets, periodicals, and maps was 65,600. Acquisitions of books and serial parts again declined in number to 10,806. More than 6,000 maps were acquired, approximately 5,000 from the Army Map Service. A number of German scientific books and periodicals, chiefly in the fields of physics and chemistry, have been purchased in reproduction through the authority of the Alien Property Custodian. The lesser number of geologic items on the market enabled the library to expend a larger portion of its book funds in building up its collection in chemistry and physics, which was inadequate in many phases of recent research touching on the work of the Geological Survey.

Other purchases reflect the emphasis on engineering geology. The Bibliography of North American Geology, 1942–43 is in press.

FIELD EQUIPMENT

Among the more unusual devices made during the past year by the Division of Field Equipment are the following:

A graph subdivider, which is used to convert graphical records of the gage heights of rivers into figures representing the daily mean discharge of such rivers.

A tick graduator, which is used for precisely dividing the distances between degree lines on map grids into 60 equal parts representing minutes and cutting the graduations ("ticks") through the photographic emulsion on glass plates.

An attachment for aerial continuous strip cameras whereby distortions in the photograph such as caused by the tilting and dipping of the airplane are largely eliminated.

A stereo plotter, which is used to plot onto maps contour lines derived by the floating dot method from vertical aerial photographs.

The devices are offering many advantages in their respective fields of stream gaging, mapping, and geologic investigations.

FUNDS

During the fiscal year 1945 there was available for expenditures under the direction of the Geological Survey a total of $12,598,873. Of this amount $6,364,160 was appropriated directly to the Geological Survey, and $6,234,713 was made available by other Federal agencies and by States and their political subdivisions. In addition, $11,800 was allotted from the appropriation for contingent expenses of the Department of the Interior for miscellaneous supplies.

Funds available to the Geological Survey in 1945 from all sources, general administrative salaries:

Interior Department Appropriation Act		$240, 490
Topographic surveys:		
Interior Department Appropriation Act	$1, 180, 360	
States, counties, and municipalities	330, 575	
War Department	1, 149, 960	
Tennessee Valley Authority	76, 000	
Public Roads Administration	57, 487	
Miscellaneous repay	209, 992	
		3, 004, 374
Geologic surveys:		
Interior Department Appropriation Act	1, 337, 970	
States, counties, and municipalities	65, 000	
Bureau of Mines	317, 000	
Board of Foreign Economic Administration	64, 000	
War Department	410, 000	
Miscellaneous repay	9, 026	
		2, 202, 996

Strategic and critical minerals:		
Interior Department Appropriation Act	$665, 000	
States, counties, and municipalities	7, 000	
State Department (for work in other American Republics)	90, 500	
Miscellaneous repay	1, 614	
		$764, 114
Mineral resources of Alaska:		
Interior Department Appropriation Act	177, 000	
Navy Department	50, 000	
War Department	600, 000	
Miscellaneous repay	3, 374	
		830, 374
Gaging streams:		
Interior Department Appropriation Act	1, 510, 000	
First Supplemental Appropriation Act	80, 000	
States, counties, and municipalities	1, 269, 370	
Permittees and licensees of Federal Power Commission	35, 865	
Department of the Interior:		
Bonneville Power Administration	5, 600	
Fish and Wildlife Service	2, 194	
Office of Indian Affairs	6, 692	
National Park Service	400	
Office of Land Utilization	17, 600	
Bureau of Reclamation	76, 465	
Miscellaneous repay	2, 775	
Commerce Department	176	
Justice Department	39	
Federal Power Commission	259	
Federal Works Agency	5, 284	
Board of Foreign Economic Administration	4, 123	
Rubber Reserve Corporation	555	
War Production Board	177	
Navy Department	1, 682	
Defense Plant Corporation	39, 671	
State Department	53, 250	
Tennessee Valley Authority	62, 500	
War Department	918, 886	
		4, 093, 563
Classification of lands:		
Interior Department Appropriation Act	240, 000	
States, counties, and municipalities	1, 875	
Federal Power Commission	38	
Miscellaneous repay	563	
		242, 476
Printing and binding:		
Interior Department Appropriation Act	87, 500	
Miscellaneous repay	24	
		87, 524
Preparation of illustrations:		
Interior Department Appropriation Act	27, 840	
Miscellaneous repay	415	
		28, 255

ngraving and printing geologic and topographic maps:		
Interior Department Appropriation Act	$235, 000	
First Deficiency Appropriation Act	26, 000	
Miscellaneous repay	176, 227	
		$437, 227
Mineral leasing:		
Interior Department Appropriation Act	557, 000	
Department of Agriculture	1, 063	
Department of Justice	297	
Navy Department	20, 825	
National Housing Agency	24	
Office of Indian Affairs	85, 000	
Reconstruction Finance Corporation	105	
Miscellaneous repay	452	
		664, 766
Payment from proceeds of sale of water, special account		2, 714
		12, 598, 873

Solid Fuels Administration for War

C. J. POTTER, ***Deputy Administrator***

* * *

DESPITE most difficult wartime problems affecting the production and distribution of coal during the past fiscal year, the American mining industry, backed by the Solid Fuels Administration for War, supplied the tremendous quantities required by war plants to turn out munitions and equipment to crush Nazi Germany and speed the defeat of Japan.

At the same time, the public, although pinched at times by winter emergencies and often having to use substitute fuels, has had enough coal to keep healthfully warm, if not always comfortable, and to maintain the wartime civilian economy at the highest level of any nation.

This is an achievement of which those who shared in it can be justifiably proud. It reflected the successful solution of many perplexing problems. It was the result of careful planning and control by the Solid Fuels Administration for War, of hard work and good management by the miners and the operators, and of cooperation between Government and industry. The coal industry performed an excellent war job.

The need for the careful, centralized planning of distribution, with adequate controls, was recognized early in the war. These activities comprised the primary function of this agency. Requirements were forecast a year ahead, production was estimated in advance, and basic distribution patterns were thus established. Industry representatives were consulted extensively in the formulation of plans and programs. The success of the entire war fuel program rested in large part, on their cooperation. Controls and regulations were kept at a minimum, and industry was given the widest possible latitude. The Administration's controls modified normal distribution as little as possible. Modifications were required in fulfillment of the objective of doing everything helpful to early and successful termination of the war.

Under such a program, producers and industrial consumers alike could schedule their operations intelligently. Sound planning revealed probable difficulties in sufficient time to permit appropriate counter measures to be taken. Of course, all conditions could not be foreseen. Particular situations arose which required emergency handling—

including snowstorms, floods, fires, sudden changes in war needs, an many other developments. But the over-all job of planning made i possible for such problems to be met with a minimum adverse effec on the general fuel supply and its distribution.

Even with many hard-won fuel battles of the war safely behind o June 30, 1945, a difficult fuel situation still existed. Germany's defea did not diminish requirements appreciably, and the mines, which ha been steadily losing manpower to the armed forces, to other industrie and because of natural attrition, no longer had sufficient men to produce all the coal needed. Stockpiles, built up to unprecedente heights under Government leadership early in the war, no longer wer adequate to tide the Nation over a serious production deficit.

In the United States, the solid fuels issue lay not in the lack of coal underground but principally in the steady loss of mine manpower. The heavy wartime drain, however, did accelerate depletion of the reserves of high-grade metallurgical and special-purpose coals, bringing nearer the time when the problem of their exhaustion must be met.

SOLID FUELS REQUIREMENTS

Because of the heavy pressure of war industrial demands and the increased financial ability of the domestic consumer to buy more fuel, soft coal requirements reached an all time peak of 626,000,000 tons during the fuel year which ended on March 31, 1945. This figure outstripped peak requirements of World War I by about 73,000,000 tons, although the situation is not entirely comparable as an index to recent wartime fuel needs, due to the great increase in fuel economy and the greater availability of other fuels during World War II.

Requirement figures for the new fuel year, beginning April 1, 1945, were initially placed at 600,000,000 tons, assuming that the war with Japan continued, reflecting anticipation of some decrease in industrial consumption under that of the 1944–45 fuel year and a 20 percent curtailment in the consumption of the eastern (districts 1, 2, 3, 4, 6, 7, 8, and 13) coals by households and other domestic users.

The fall of Germany caused little further downward revision in these estimates because war production needs for the defeat of Japan continued high.

The war caused shifts on the fuel front which made it necessary for the anthracite industry to take on an unexpected burden of a large number of new consumers when supplies of fuel oil, wood, and coke became short. Total hard coal requirements were estimated at 66,100,000 tons for the 1944–45 fuel year and the figure was increased to 67,000,000 tons for the 1945–46 fuel year. (The 67,000,000-ton production would be required to supply the needed volume of domestic sizes.)

Byproduct coke requirements were high in the early part of the past fiscal year because of the continuing demands for manufacturing pig iron and steel. This placed a burden on anthracite in certain areas.

Industrial requirements decreased, however, from September 1944 to May 1945, due to general expectations of an early end to the war in Europe.

During the fuel year which ended March 31, 1945, approximately 60,372,821 tons of byproduct coke were shipped to industries requiring that fuel. The movement of byproduct coke to domestic consumers was estimated at 6,407,900 tons. Reclaimed beehive coke provided as an alternative fuel for consumers of scarce solid fuels during the year totaled 713,000 tons, and rescreened byproduct coke, 147,000 tons.

PRODUCTION—MANPOWER SITUATION

Bituminous coal production in the calendar year 1944 was the largest of all time, totaling 620,000,000 tons. Production in the fuel year ending March 31, 1945, dropped to 610,000,000 tons, or about 10,000,000 tons below requirements, and estimates for the 1945–46 fuel year point to a maximum output of some 575,000,000 tons.

Production of anthracite in the 1944–45 fuel year totaled approximately 61,287,000 tons. Indications are that hard coal production in the 1945–46 fuel year will not exceed 55,000,000 tons.

The coal production problem, reduced to its simplest terms, was inadequate manpower aggravated by strikes. On April 1, 1945, an estimated 378,000 workers were employed at bituminous mines, the lowest figure in 43 years. Anthractie employment was put at 72,000, the lowest since the early days of that industry.

Trends at the start of the 1945–46 fuel year indicated that bituminous mine manpower would decrease an additional 19,000 before the end of that year, due largely to accidents, deaths, and retirements. In the anthracite mines, a further net loss of some 3,000 workers was expected.

The Solid Fuels Administration appealed vigorously but unsuccessfully for the release of adequate manpower from 30,000 younger mine workers in military service. By agreement with the Selective Service System, draft deferments were obtained for some 27,000 mine workers during the past fiscal year.

Recurrent strikes throughout much of the 1944–45 fuel year further retarded coal production. A strike which started July 3, 1944, at the anthracite mining properties of the Philadelphia and Reading Coal & Iron Co., near Shenandoah, Pa., cost consumers 500,000 tons of hard coal before it was terminated on August 23 after the Government took possession. These properties were operated under Government possession until April 18, 1945, when they were returned to the owners.

Fostering increased mine output by every possible means, the Solid Fuels Administration for War assisted the industry in carrying out various incentive programs. In addition the Administration assisted mine operators in obtaining new equipment to replace worn out tools and machinery. The Administration aided in having roads constructed to new mine pits and stripping operations and helped retail dealers obtain tires for their trucks. Successful representations were made to the Office of Price Administration to obtain larger supplies of meat for mine workers, many of whom complained that they were unable to continue their work without increased rations.

COOPERATION IN LABOR MATTERS

Production in bituminous coal mines suffered heavily in August and September 1944 because of a wave of so-called "supervisory" employee strikes. These started in the northern Appalachian mining districts and spread south, affecting principally the mines producing vitally needed special-purpose coals. In order to restore production, it was necessary for the Government to take possession of 72 mining properties, which remained under its control until February 24, 1945.

In the spring of 1945, the Secretary of the Interior, at the direction of the President, took possession of 272 soft coal operations and 354 anthracite companies to minimize losses of production due to strikes attending a break-down in wage negotiations. Possession of the mines was administered by the Solid Fuels Administrator for War until after the wage controversies were settled. When anthracite wage negotiations became stalemated, Secretary Ickes called the opposing parties together and suggested a basis for further consultations which resulted in an agreement. With these matters settled, all but a small number of mines that had been taken over by the Government subsequently were returned to their owners.

Estimated losses of potential production due directly to strikes in the 1944–45 fuel year were 13,835,000 tons of bituminous coal and 5,098,000 tons of anthracite.

DISTRIBUTION OF SOLID FUELS

With coal supplies falling behind requirements throughout the fiscal year, it was necessary for the Solid Fuels Administration for War to exercise controls over distribution in order to prevent interruption of vital war industries and hardship to civilians.

On August 1, 1944, retail deliveries of scarce Southern Appalachian bituminous coals were limited to 90 percent of 1943–44 receipts. A regulation was issued requiring shippers of scarce Southern Appalachian coals to maintain three categories of shipping preferences. The shippers were ordered to fill first the needs for byproduct and special purpose coals, then to fulfill commitments on coal ordered for movement by water during the Great Lakes navigation season to dock operators. Third preference was given to orders from retail dealers.

That regulation also established three "consumer areas," in which priorities were given for shipping the scarce Southern Appalachian coals to retail dealers. Southeastern States which had no alternative source of solid fuels were given first priority. The second area embraced regions receiving their coal by Great Lakes vessels. Midwestern States which have alternative fuels comprised the third consumer area.

The shortage of high grade Appalachian bituminous coals became so acute by August 1944 that the Solid Fuels Administration for War, in order to protect wartime steel production, ordered the diversion of some 1,680,000 tons over a period of several months from industrial plants using it for generating steam to steel and coking plants.

Heavy inroads on Midwestern bituminous coal, coupled with production difficulties occasioned by bad weather, compelled action in December to restrict shipments of fresh-mined coal by producers to industrial consumers in proportion to their stock piles. Many industries which had comparatively large stocks on hand were obliged, therefore, to withdraw from those stocks for day-to-day burning needs to provide more new-mined coal for others whose stocks were being depleted too rapidly for safety.

In January 1945, extremely heavy snowfall hampered rail transportation in many eastern States, making temporary railroad embargoes necessary. Producers in Southern Appalachian mining districts were requested not to ship coal west of Pittsburgh and north of Central Ohio, Indiana, and Illinois during the embargoes because of car shortages. As an emergency measure, retail deliveries also were limited for a short time and diversions of coal in transit were made in order to supply dealers whose yards were nearly empty. The cooperation of local authorities in many cities and towns was obtained in assuring that every one had at least enough solid fuel to prevent acute suffering.

Equitable distribution of anthracite, the primary market for which is among household consumers in the Northeastern and Middle Atlantic States, was carried out successfully in the past fiscal year despite the serious production deficit and numerous delivery handicaps

A critical emergency was created in fuel distribution by the series of heavy snowstorms which formed ice in many northeastern rail terminals, freezing cars to the rails and coal in the cars. For a time shipping and retail delivering in northern, central, and western New York State was completely disrupted.

At the start of the 1944–45 fuel year, distribution of hard coal from producers and wholesalers was planned on a basis of 90 percent of adjusted 1942–43 base period tonnages. The deficit of production under requirements, however, exceeded earlier estimates, and in August shipments by producers and wholesalers to retail dealers were cut to 87½ percent. In February and March of the fuel year it was necessary to reduce this figure to 80 percent.

Adhering to principles adopted at the beginning of anthracite distribution controls, the Solid Fuels Administration for War continued to make upward adjustments of dealer quotas wherever this was made necessary by population increases, conversions from other fuels and similar changes in requirements.

The Solid Fuels Administration for War assisted the anthracite industry in disposing of some of the excess fine sizes of hard coal which were not suitable for home heating, through the development of new markets. Encouragement was given to manufacturers of processed fuel to use these small sizes and some were shipped abroad as a substitute for fuels normally used.

In the distribution of anthracite in sizes suitable for heating, the Administration gave a preference to poultry brooders and hatcheries because of their essentiality as wartime food producers.

Anthracite production during the 6 months preceding the end of the 1945–46 fuel year fell 19 percent below that of the comparable period of the previous year, and at this time the prospect is that the industry's output will be substantially short of requirements.

Distribution of coke during the past fiscal year was a problem the solution of which lay chiefly in supplying coke plants with adequate tonnages of suitable coals. During the last 3 months of the fiscal year—from April 1 to July 1945—it was necessary to divert byproduct coke from the domestic market to meet the requirements of industrial users. This demand, however, tapered off in the latter part of June, releasing additional supplies for domestic consumption.

Throughout the fiscal year the Solid Fuels Administration for War continuously urged persons using anthracite for heating purposes to accept deliveries of reclaimed coke to supplement short supplies of their customary fuel. Wherever this advice was followed, purchasers were able to stretch their heating fuels farther during the winter months.

Special problems arising in connection with the distribution of solid fuels included providing adequate fuel supplies for regions which normally receive their winter's supplies of coal by water over the Great Lakes shipping routes. Slightly more than 58,000,000 tons of coal were forwarded from lower lake ports during the 1944 navigation season—an all-time record achieved under a regulation of the Solid Fuels Administration for War requiring uniform monthly shipments.

Taking cognizance of the prospect that production during 1945 would continue to decrease, the Solid Fuels Administration for War directed Great Lakes dock operators to inform their suppliers by February 16 of the amounts, grades, and sizes they would require for a year from May 15, 1945. At the same time retail dealers were ordered to supply the dock operators with detailed information as to the needs of their industrial customers. This information formed the basis whereby producers could gauge their shipments during the season of navigation.

Industrial stockpiles were increased during the summer and fall of 1944 from a low of 50,513,000 tons on May 1, to a high of 65,074,000 tons on November 1, but mine manpower shortages and strikes made it impossible to build them up sufficiently to offset the additional winter consumption requirements. From November until the end of the fuel year on March 31, 1945, stockpiles declined again to 45,495,000 tons. This decline continued until May 1, 1945, when stockpiles reached their lowest point of the war—43,793,000 tons. During the remainder of the spring they began to rise again, reaching 47,718,000 tons by the end of the fiscal year.

DISTRIBUTION PROGRAM FOR 1945–46

Serious shortages of solid fuels in prospect early in 1945 compelled thorough revision of the Administration's distribution program. One of the regulations drafted for the 1945–46 fuel year laid the basis for allocations of special purpose coals, protecting them against uses which would tend to handicap the national war effort.

Other outstanding features of the 1945–46 distribution program included: (1) Limitation of dealer quotas for the scarce eastern solid fuels to 80 percent of the dealer's receipts in a base year period; (2) limitation of retail deliveries of anthracite, eastern-mined bituminous coal, coke, and packaged fuels to 80 percent of the consumer's normal annual requirements; (3) giving a third priority on soft coal to be moved to the Great Lakes and stipulating that the lake movement was to be completed by November 17, 1945; (4) continuation of tight controls on industrial coal distribution and stock piling; (5) requiring that "over-the-road" anthracite truckers secure SFAW licenses to assure a more equitable distribution by truck and by rail; and (6) encouraging spring and summer storage of solid fuels by as many consumers as possible under conditions of short supply.

To assure the widest possible spread of solid fuels during the 1945–46 fuel year, the new regulation required consumers using them for heat in all States east of the Mississippi and in certain areas west of that river to file "consumer declarations" with their retail dealers to show how many tons their premises normally required for a year.

A similar method of retail distribution already had been in use by anthracite consumers and had operated successfully in lieu of coupon rationing. Solid fuels consumers who filed the declaration were limited to 80 percent of their normal annual requirements of the scarcer kinds of fuel. Toward the end of the fiscal year this limitation was removed with respect to midwestern-mined soft coal.

Local advisory committees were continued in all States in which fuel was scarce to assist domestic consumers and retail dealers with respect to fuel problems. Provisions were made in regulations whereby the so-called "orphan" consumers were helped to get coal. (These were consumers who were either new in a community or for some other reason had no regular retail supplier.)

WAGE AND PRICE STABILIZATION

Consistent with the responsibility of the Solid Fuels Administration for War to maintain production at the highest possible level within the established stabilization policy, the agency frequently recommended to the Office of Price Administration the establishment of prices for solid fuels that would encourage or protect coal output. In making such recommendations, the Administration reviewed in detail the cost and realization figures where the application for price adjustment affected a complete production district, a production subdistrict, or any considerable group of mines.

On general price revisions or on those affecting mines of large production, the Solid Fuels Administration for War made recommendations to the Director of Economic Stabilization which supplied him with information useful in passing upon recommendations of the Office of Price Administration. Also, in connection with wage stabilization, the Administration furnished data and advice to the War Labor Board.

CONSERVATION OF FUELS

Fuel conservation became an important wartime measure during the fuel year 1944–45. The reduction in supplies made it necessary for householders and industries alike to take vigorous steps to avert fuel waste. It was necessary to convince the public of the need to save fuel through programs of education in methods of accomplishing fuel savings.

Mass educational and promotional procedures were used to obtain the cooperation of the household consumers, while the industrial activities largely consisted of engineering advice, carried on through the National Fuel Efficiency program of the Bureau of Mines.

The part of the program pertaining to household consumers was carried on directly by the Solid Fuels Administration for War, with the help of State governments in areas where fuel was most critically short, and with the aid of the Office of War Information. The Governors of 25 States in the critical areas appointed State Fuel Conservation Directors who cooperated with the Federal Government in the issuance of information to promote fuel savings. Basic information, and a small amount of educational materials were supplied the states by the Solid Fuels Administration for War, which coordinated State and Federal activities in connection with this program. With the cooperation of the Office of War Information, the Solid Fuels Administration for War carried on a program of public education, employing such media as radio, press, motion pictures, posters, and circulars.

The funds appropriated for public informational activities were exceedingly inadequate as compared to the size and importance of the task, making it necessary for the Solid Fuels Administration for War to appeal to and depend largely upon the expenditures of business organizations and other interested groups. The radio industry and its advertisers devoted broadcasting time freely to fuel messages. Government advertising material was placed in the hands of private business organizations and associations which reproduced and distributed it, or sponsored and paid for its use as commercial advertising by the radio and press.

During the warm months, steps were taken to encourage the public to prepare for winter by ordering and storing whatever fuel was available, cleaning and repairing heating equipment, insulating and otherwise making homes and other buildings "heat tight." During the heating season, more direct conservation measures such as delaying the starting of fires in the fall and extinguishing them early in the spring, preventing overheating, or inefficient furnace firing, were advocated.

COMPLIANCE WITH REGULATIONS

Considerable credit for the generally excellent compliance with wartime fuel regulations is due to the coal industry for its cooperation. The job of distributing fuel fairly could not have been done, however, without the compliance activities of the Administration, important among which were the efforts taken to explain to the trade the regulations and directions by which solid fuels were distributed, their purposes and necessity.

Violations were relatively few, considering the many thousands of producers, distributors, dealers, truckers and consumers affected. In most cases, maldistribution resulting from detected violations was corrected by adjustment of shipping schedules, and in some instances, by the elimination of untrustworthy channels of distribution.

Because there was sufficient coal to supply household consumers with a reduced percentage of their normal requirements, it fell upon Solid Fuels Administration for War to see that they received their full share in tons of the available supply, and that the limited supply was not adversely affected by deliveries of coals containing excessive ash. It was necessary to suspend the operation of some 20 anthracite mines for various periods because fuel containing excessive ash was shipped from them. Violations of all types averaged about 100 per month.[1]

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[1] The war had ended by the time this report was written. The solid fuels outlook for the 1945–46 fuel year was still clouded, however, by the delayed return of manpower to the mines from the armed services and from employment in war industries in time to make possible the production of adequate coal for all purposes.

In general, the supply of the lower grades of coal appeared adequate, but the Nation was still confronted with a serious shortage of the higher grade bituminous coals produced in the east and of anthracite. It unquestionably will be necessary to continue exercising certain controls over the distribution of solid fuels throughout the 1945–46 fuel year, and for the public to accept alternative fuels wherever preferred types or sizes are not available.

Petroleum Conservation Division

E. B. SWANSON, ***Acting Director***

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THE Connally "Hot Oil" Act, approved February 22, 1935, delegates to the President prescribed powers "to regulate interstate and foreign commerce in petroleum and its products by prohibiting the shipment in such commerce of petroleum or products moved in excess of amounts allowed by State law and for other purposes."

Acting through the Secretary of the Interior as the designated agent of the President, the Petroleum Conservation Division was established to assist in the prescribed administration of the act, to cooperate with oil and gas producing states in the prevention of waste and the adoption of uniform oil and gas conservation laws, and to keep informed as to the movement in interstate commerce of petroleum and its products with respect to its parity between supply and consumptive demand.

FEDERAL PETROLEUM BOARD

The Federal Petroleum Board with its head office in Kilgore, Tex., and field offices at Lafayette, La.; Corpus Christi, Houston, and Midland, Tex., administers the regulations prescribed under the Connally Act. While the act is applicable to any State having an oil proration law, the supervisory operations of the Federal Petroleum Board are now confined to 106 counties in Texas, two producing counties of New Mexico, and the entire State of Louisiana. Within this area, monthly production reports are not required for "stripper" fields. Eliminating these, the designated area includes 476 oil fields, 59,323 wells, 78 refineries, and 129 gasoline plants. Daily production averages 2,110,604 barrels of oil and 132,599 barrels of casinghead gasoline and other liquids. This is 75.37 percent of the total output for New Mexico, Texas, and Louisiana or 41.96 percent of national output. The refineries process a daily average of 1,679,189 barrels of products. The daily average increase in production, within the designated area, over the fiscal year 1944, is as follows: Barrels of crude oil, 10.2 percent; barrels of petroleum products, 16.1 percent; barrels of casinghead gasoline, 25.6 percent.

Although the Board's area for supervision does not include all territory in which State proration laws are applicable, action can be and is instigated by the Federal Petroleum Board when Connally Act violations occur outside of the supervised area but within a State proration area.

The enforcement of the act and administration of the regulations is essentially a specialized field operation requiring, among other things, routine and special inspections. This function is necessary to maintain effective control over the interstate movement of petroleum and its products. As a result of this control, illegal practices are reduced and a maximum compliance with conservation laws is maintained in oil operations.

Activities of the Federal Petroleum Board have been curtailed by reduction in experienced personnel and by other wartime handicaps. Yet the volume of criminal investigative operations has been maintained at an effective level. Changing economic conditions have reduced the incentive for Connally Act violation and continued supervisory operations have acted as a deterrent. The Board's personnel has been for several months in a position to report on technical and economic conditions within the Board's area.

During the fiscal year J. W. Steele retired as chairman, and member Ray O. Armstrong was appointed chairman.

As of July 1, 1944, there were seven Connally Act cases which had been referred to the Attorney General pending action by the Department of Justice and six major investigations in progress. Evidence had been developed in the six investigations to such an extent as to allow for allegations of Connally Act violation. Of these 13 cases, 4 were prosecuted successfully, and $12,100 in fines collected. Indictments have been secured in two other cases and they are now ready for trial. The two indictments name two corporations and 21 persons. Civil action involved in three cases has been conducted effectively in the Government's interest and criminal action against respondents has been started. One of the cases in investigative status at the beginning of the fiscal year has been compiled and presented to the Department of Justice, another will be offered shortly. Two of the cases in an investigative status have been closed by administrative action because it was found that prosecution would not be advisable or justified. The thirteenth case remains pending in the Department where it has been for several years awaiting apprehension of the indicted.

On December 1, 1944, by Order No. 2012, the Secretary established a Departmental Petroleum Committee, which consists of the Director of the Geological Survey, Director of the Bureau of Mines, Assistant Commissioner of the General Land Office, Assistant Solicitor and the Director of the Petroleum Conservation Division, as Chairman.

The Committee reviews and coordinates the petroleum work of the several agencies of the Department and makes recommendations to the Secretary as to changes which may be necessary or desirable to increase the effectiveness of the work.

Comparative analyses of production data by fiscal years

	Crude production		Percentags of production to total in United States
	United States	Reported to Federal Petroleum Board	
	Barrels	*Barrels*	
Fiscal year 1942	1, 409, 015, 000	547, 627, 750	38. 9
Fiscal year 1943	1, 418, 609, 000	550, 412, 012	38. 8
Fiscal year 1944	1, 559, 141, 000	710, 014, 166	44. 4
Fiscal year 1945	1, 721, 956, 559	770, 370, 489	44. 7

General Land Office

FRED W. JOHNSON, *Commissioner*

POSTWAR administration of public lands roughly estimated as representing nearly a quarter-billion dollars' worth of real estate owned by the American people, is the paramount task confronting the General Land Office at the close of the 1945 fiscal year. Taking into account the intangible assets inherent in the 778 million acres of the public domain in the United States and Alaska and the mineral deposits and other resources in the land, this property is an important factor in national economic advancement during the reconversion period. Its continued management under progressive conservation policies for use and development with an eye to the requirements of the future, is essential. In no other way can the domestic demands for maximum beneficial use of the land and resources of the public domain, adequately be met.

Already, the trend of scientific research has pointed the way to new fields of usefulness for the public domain, broadening the scope of activities in the development of resources beneath the surface and expanding the opportunities for utilization of the land itself. The wider horizons for mineral uses revealed by the discovery and development of atomic energy, the steadily mounting requirements for lumber and other forest products to repair the ravages of war, and the growing demands from ex-servicemen for land settlement opportunities serve to illustrate the trend toward more extensive usage in the years immediately ahead.

Obviously, this contribution to future economic advancement cannot help but enhance the value to the American people of their public domain. However, it will also bring a corresponding increase in the responsibilities facing the General Land Office. New methods and new laws must be provided with which to carry out these new tasks which, in effect, mark the beginning of a new era in national land administration.

ESTIMATE OF VALUE

There is a wide range of fluctuation in the evaluation of land. Current conditions and demands can change such calculations overnight. Who, for instance, can predict with accuracy the worth of areas destined to become homes of future settlers in Alaska, or estimate the ultimate monetary value of mineral-bearing lands? Nevertheless, some idea of the value of the public land is essential to the determination of its worth as a national asset of the United States.

It has been conservatively estimated that the public lands of the United States on the continent and in Alaska represent real estate values aggregating $235,000,000, of which $125,000,000 worth is located in the United States. Roughly divided, the assets comprise forest lands and woodlands worth $160,000,000, grazing lands whose value is conservatively placed at $30,000,000, and other lands including barren areas as well as areas devoted to special use, valued at $45,000,000. In addition to this conservative evaluation of the land, technical services rendered by the General Land Office to the public and to agencies of both Federal and State governments constitute other less tangible factors whose value conservatively is estimated to bring the total worth of the people's assets in this real estate to $250,000,000.

NEW PROBLEMS

Land administration experiences in connection with the prosecution of the war have sharply accentuated the pattern for efficient management of the public domain in time of peace. At the close of the 1945 fiscal year, definite alterations in Federal law and in procedures of the General Land Office were revealed as imperatively needed to bring about that efficiency to which the public is entitled and without which the maximum beneficial use of the national lands and their resources cannot be assured. Some of these needs long had been recognized, but their accomplishment was held in abeyance for the duration of the war. Today, freed from the restrictions arising from the necessity for emergency military action, these problems await solution:

1. Rejuvenation of our Federal mining laws is essential. Mechanized warfare has demonstrated that minerals are indispensable in modern war; under present statutes, no method exists for securing to the United States the utmost advantages from the development of such resources on lands under its control. No real mining conservation, a vital factor in the postwar economy, can be brought about without Federal law granting authority for the United States to supervise the minerals which it owns. Except for statutes governing the development of the fuel and fertilizer minerals in the public lands,

no such authority exists at present. A general leasing system applicable to all minerals would provide the Government with not only the power to conserve but the opportunity to catalog and classify its natural assets to insure their maximum beneficial use during the reconversion period.

2. Legislation is needed to extend the salutary provisions of the present mineral leasing law to lands acquired by the Government, as well as to the original public domain. Specifically, lands acquired by Federal agencies under the National Industrial Recovery Act, the Bankhead-Jones Farm Tenant Act and various relief appropriations and rehabilitation acts, together with the public lands, constitute a veritable storehouse of essential minerals. Without the enactment of new laws, the United States may not catalog and in cooperation with private initiative develop the resources on these acquired lands through leases based on sound principles of conservation.

3. Another element essential to the successful administration of the public domain, both in relation to mineral resource development and the general management of the Federal estate along conservation lines during the postwar period, is complete, authentic information as to the character and status of the land. At the present time, evidence of the filing of thousands of unpatented mining claims is not made a matter of Federal record, but is solely registered in county recording offices. The enactment of legislation to enable the recording of such evidence in the General Land Office is urgently recommended.

4. Similarly, another of the serious handicaps to proper administration of the nation's assets is the lack of any facilities by which detailed information can be secured concerning the real estate holdings of the various branches of the Federal Government. The establishment within the General Land Office of a centralized, consolidated inventory of all such land records is recommended as a solution of this problem.

5. From time to time, areas of the Federal domain have been withdrawn from general use by the public in order that broader programs of national development might be facilitated. A careful survey of these withdrawals should be undertaken, and a reduction in the size of the areas withdrawn be brought about wherever feasible in the public interest. By this means, portions of the hitherto withdrawn lands may be restored to their public land status and the land and its resources made available for more general utilization in the postwar period.

6. A reexamination of the public lands to discover whether any tracts hitherto overlooked may be suitable for homestead use by veterans or the general public, is suggested as an appropriate part of

any program for the maximum beneficial use of the natural resources of the Nation.

7. Similarly, a thoroughgoing study of the statutes and administrative procedures for homesteading on the public domain should be undertaken with a view of extending all possible assistance in the placement of returned veterans upon the land.

8. Greater speed and flexibility in the solution of all factors in the veterans' homestead problem should be facilitated through decentralization of administrative operations made possible by additional legislative authority and funds.

9. Many of the 5,000 public land laws under which administration of the public domain is carried on by the General Land Office were enacted more than a half-century ago, and many others have reached a stage of obsolescence incompatible with the requirements of efficient management of the nation's real estate assets during the years immediately ahead. A survey of the Federal land laws and a modern streamlining of their provisions should be made as a prime requisite to adequate public land administration.

10. Meantime, maximum use of the public lands and their resources can be enhanced by the enactment of a uniform Federal trespass law which would afford greater protection against the unlawful acquisition and wasteful dissipation of these national assets.

11. War legislation authorizing the disposal by the Government of sand, stone, gravel, vegetation, timber and other forest products on public lands of the United States should be embodied in permanent law, in order that these natural resources may be made available for construction purposes during the postwar period.

12. The development of Alaska through increased land settlement will require the utmost in service and safeguards for the public if economic advancement is to be attained on a permanently stabilized basis. Protection against ill-advised use of the public domain in the Territory, similar to that provided on the mainland through the requirements for classification of land tracts for the best use to which they may be put, would do much to solve this postwar problem. For this reason, the passage of legislation making such classification statutes applicable to the public land in Alaska is urgently recommended.

PLANS FOR THE FUTURE

Full benefit from the use of the public land depends, however, upon much more than mere legislative enactments, important though they may be to the proper administration of the people's quarter-billion dollar estate. It depends also upon a program of utilization based upon a carefully-planned integration of the objectives and operations of the General Land Office.

During the war years, the planning units of the Office facilitated the quick servicing of demands for land and resources required for the prosecution of the military program. For example, more than 16 million acres of the public domain were made available as sites for camps, gunnery ranges, aviation bombing fields, tank training areas, and other combat training uses. In addition, many secret withdrawals of land were made to assist the Army and Navy in carrying on the war, and several millions of acres were placed in a state of reserve to permit the untrammeled development for war purposes of the petroleum and other mineral resources in the areas. At the same time, the activities of trained investigators and cadastral engineers and other experts in land identification, classification and management were centered almost entirely upon war-connected tasks, ranging from the examination of thousands of mining claims to the segregation of areas in Arizona, New Mexico and other States for use in experimentation and in the development of the atomic bomb.

Never before in history had the public lands under the jurisdiction of the General Land Office been called upon to provide such an abundant supply of natural resources for military purposes as in the period of World War II which drew near to a close with the end of the 1945 fiscal year.

Most of this land, like the manpower of the nation which entered the armed forces, is scheduled to return to its former "civilian" status after the need for military use has passed. The orders providing for the "enlistment" of the tracts for service in the war stipulate their eventual return to the public domain. The "discharge processing" and subsequent administration under national conservation of these lands is one of the reconversion tasks confronting the General Land Office in the immediate future.

Land Settlement Opportunities

The end of the war has centered the thoughts of many American servicemen and servicewomen upon the prospects for establishing a permanent home upon the public lands of the United States. Visualizing broad opportunities for settlement such as existed in the earlier stages of American history, thousands of members of the armed forces turned to the General Land Office during the last fiscal year for information and guidance in matters connected with the Federal homestead laws. A special leaflet, dealing in terse, question-and-answer form with the problems of homesteading on land in continental United States, was prepared for the benefit of the men and women in the military service, and distribution of other informational material dealing with the public lands both on the mainland and in Alaska was stepped up in response to popular demand.

While prepared to render all possible assistance in the solution of land settlement problems for both military personnel and civilians, attention is called by the General Land Office to the fact that, since homesteading as popularly understood first was set under way by

President Abraham Lincoln 83 years ago, good farm land upon which an agricultural living can be made as required by the homestead law is scarce on the vacant, unappropriated, and unreserved public domain in the United States.

Meanwhile, another type of use of the public lands which does not require the making of a living by agriculture, has grown during 1945 to become one of the major operational problems confronting the Office. This opportunity for land settlement by World War veterans as well as civilians is afforded under the terms of a law which authorizes the lease or sale of not to exceed 5 acres of public land for home, camp, cabin, health, convalescent, recreational, or business purposes.

Popularity of the plan is indicated by the fact that applications for leases under the law totaled more than 3,200 in 1945, as compared with only 1,600 during the preceding 6-year period. To help meet this increased demand, special land examinations had to be made, with the result that more than 30,000 acres of land, the major portion of which is located in Southern California, were recommended for classification as suitable for use under the Small Tract Act.

As the fiscal year drew to a close with prospects for a rapid return of service personnel to a civilian status, interest in the small tract land settlement program increased, areas in the vicinity of Tucson and Phoenix, Ariz., Sacramento, Calif., and Denver, Colo., being applied for, as well as tracts in Idaho, Nevada, New Mexico, and Oregon. Further expansion of the program to provide still more areas for lease and a streamlining of administrative processes to facilitate the work is an essential task confronting the General Land Office in the postwar period.

ALASKAN DEVELOPMENT

The fact that more than nine-tenths of the 375 million acres of land and water in Alaska consist of public domain remaining in Federal ownership places upon the General Land Office a large share of direct responsibility for the proper administration and development of the natural resources of the Territory. Foremost among these is the obligation to furnish authentic information concerning the various types of land-use opportunities within its borders. During 1945, this requirement was met in part by the distribution of an information bulletin on Alaska which not only has served as a standard reference publication for other Federal agencies and members of Congress, but also has provided thousands of servicemen and women with data relating to the privileges and obligations inherent in the administration of the public land laws in Alaska.

Shortly after the close of the fiscal year, Congress enacted a law making the provisions of the Small Tract Act which hitherto had been confined to continental United States, equally applicable to the public lands in Alaska. As a result, plans were immediately set under way to gear General Land Office operations in the Territory to the requirements of the new law.

At the same time, definite steps were taken for strengthening the organization in Alaska to render effective service in meeting land settlement and other problems of resource development during the postwar period. Specifically, a new regional field office of the Branch of Field Examination was established at Anchorage to handle matters formerly routed through San Francisco, while the Alaskan Fire Control Service was vested with broader authority in the protection of public land areas from fire and in the use of timber from the public domain. In addition, special examination of some of the public lands in the Territory was made during the summer of 1945 to insure up-to-date evaluation of the areas from the standpoint of suitability for agriculture or other use in the economic development of Alaska.

Sustained Yield Conservation

Maximum benefits from the natural resources of the United States in the postwar period will require a complete cessation of the haphazard use which in former years led to denuded timbered areas, abandoned "ghost towns," and the depletion through overgrazing of the rangelands of the West and Southwest. Responsibility for the attainment of this goal on the public lands under national conservation policies rests in large measure upon the operational activities of the General Land Office.

Foremost among its obligations in this field is the establishment of sustained-yield forest-management practices on all the Federal lands under its jurisdiction, as required by Congressional mandate enacted during the 1945 fiscal year. Under this program, forestry operations on the timbered public domain eventually will be brought into a balanced ratio in which the volume of tree-cutting and of tree-growing will be regulated so as to provide a continuing supply of those natural resources on the land.

Adequate protection from fire of the 262,500,000 acres of timber, grass and brush land areas of the public domain in the United States and Alaska also is an additional administrative task assumed by the General Land Office during 1945, and plans were completed at the close of the fiscal year to preserve these resources for postwar use.

REVIEW OF THE YEAR'S WORK

The dual task of meeting the public land requirements in the Nation's war program while orienting its operations to respond to the demands for public service in the postwar period, highlighted the record of accomplishment of the General Land Office during the 1945 fiscal year. Operating through 4 branches with 12 divisions in Washington, 5 agencies in the field with 25 offices scattered throughout the

West and in Alaska, and 25 district land offices also strategically located for service in the West and in the Territory, this official rea estate agent of the Federal Government closed its books for the perio with a net profit both in conservation advancement and in financia gains resulting from its year's work.

RECEIPTS AND EXPENDITURES

In the aggregate, the activities of the General Land Office produc cash returns several times greater than the expenditures incident to it operations. In 1945, these cash receipts totaled $13,381,654 an represented a ratio of $5.66 for every $1 of the expenditures which aggregated $2,365,005. This was the second consecutive year ir which the receipts exceeded $13,000,000, and the fourth time that receipts of the General Land Office have exceeded $10,000,000 since 1880.

Last year's receipts totaled $14,355,342, and expenditures $2,321,664.

Oregon and California Revested Lands Administration

World demands for lumber and other forest products in the post-war period were reflected in operations and plans of the Oregon and California Revested Lands Administration during the 1945 fiscal year. Established in 1938 to carry out a broad program of sustained yield forestry management on 2½ million acres of land in western Oregon, which once was encompassed in a Federal railroad grant but later revested in Government ownership, this branch of the General Land Office maintains its headquarters at Portland, Oreg.

Rated as the world's largest experimental laboratory in practical cooperative sustained yield forest management, the "O. and C." lands provide the testing ground for a world pattern of forestry economy. Under this program all elements would join in operations under which tree growing would reasonably balance tree cutting to the end that a continuing supply of raw materials will be available for the existence of industry and dependent communities. Definite plans for the further advancement of the sustained-yield program in the Pacific Northwest were made by the "O. and C." Administration during the last fiscal year.

Meantime, definite contributions to the Nation's lumber needs were made during the year from the "O. and C." lands which contain one of the finest stands of Douglas fir trees in the United States. In 1945, sales of timber from these lands exceeded 426,000,000 board feet valued at approximately $1,518,000.

The use of aerial mapping as a means of more speedily completing an inventory of timber resources in the "O. and C." lands is expected to form a part of the work program for 1946.

Further augmenting the post-war program for betterments in the industry on the Pacific coast is the planting of seedlings on the de nuded lands by the "O. and C." organization. Utilizing Civilian Public Service enrollees, more than 1,550,000 seedlings were planted and 350,000 trees prepared for transplanting in the field during the year.

With the end of the war, studies for broader use of the "O. and C." lands for recreational, grazing and other uses which were laid aside during the emergency, were ready to be resumed at the close of the 1945 fiscal year.

Cadastral Engineering Service

Plans for reorganization of this scientific branch of the General Land Office so as to meet the demands for accurate surveys in connection with land administration during the postwar period were brought to a completion near the close of the 1945 fiscal year. Involving the transfer of headquarters for this work from Denver to Washington, D. C., the reconversion program of the Cadastral Engineering Service contemplates the execution of a greater amount of actual survey work in the field than in previous years.

One of the major requirements in the first transfer of land from Government to private ownership, cadastral surveying consists of careful measurement of areas on the ground, the recording of such measurements by the placing of monuments or other markers, and the preparation of maps scientifically compiled from field notes made by trained engineers at the time of the on-the-ground measurements.

First undertaken 150 years ago in accordance with the ordinance of 1795, these surveys were carried on in 23 States and the Territory of Alaska in order that the identification of the assets in the people's quarter-billion-dollar real estate might be adequately protected in 1945.

Altogether a total of 9,231 miles was surveyed or resurveyed in 1945, some of the 1,287,490 acres being encompassed in areas acquired for military purposes.

With an increase in land settlement in Alaska looming large as a potential postwar development, the plans of the Cadastral Engineering Service include an expansion of survey work in that Territory.

Branch of Field Examination

The examination of land upon which is based the rejection or approval of plans for its use under the public land laws, is the major responsibility of this branch of the General Land Office. By maintaining a staff of trained technicians including mining and civil engineers, geologists, lawyers, auditors, timber cruisers, range specialists, and others experienced in land investigations, the branch handled many difficult and unusual types of cases during 1945.

For example, the reappraisal of unsold lots in a townsite in upper Miami Beach, Fla., was made by field examiners from this agency and the subsequent auction sale brought out bidders who ran prices up to a new high in Florida beach property.

At another period of the year agents of the branch were assigned to investigate mining claims on areas set aside as military bombing ranges, while a third group made extensive investigations in the now famous Alamogordo area where the atomic bomb experimentation was carried on.

Paving the way for more efficient service to the public in the development of Alaska, a new regional office was established at Anchorage. Other regional offices maintained by the Branch of Field Examination are located in San Francisco, Calif.; Billings, Mont.; Salt Lake City, Utah; and Albuquerque, N. Mex.

Responsibilities placed upon the General Land Office by Congress in the enactment of the sustained yield forestry management act greatly increased the task of the Branch of Field Examination during the 1945 fiscal year in preventing trespass upon the public domain. Altogether, over $70,000 was collected in payment of trespass violations of the public land laws.

Alaskan Fire Control Service

Prospects of post-war development of Alaska which will increase its burdens in the prevention and suppression of fires on more than 250,000,000 acres of public domain in the Territory, confronted the Alaskan Fire Control Service at the end of the 1945 fiscal year. The end of the war is expected to bring about an unprecedented number of tourists and settlers, the reopening of mining operations, and the construction of new airfields and roads, all of which will present new and greater fire hazards.

At the same time, increased popular interest in the Territory will bring about greater demands for the use of the timber and other natural resources of Alaska. In order that full coordination may be attained in both the protection and utilization of the timber resources, expansion of the operations of the Alaskan Fire Control Service to include management and disposal of the timber on the public lands in the Territory, was begun during the year.

Meanwhile, favorable weather conditions in 1945 resulted in the new smallest fire loss in the 6-year history of the organization. During the year, the Service took action on 57 fires with a total burned area of 2,535 acres, of which 624 acres were on private land. There were 13 fires inaccessible to the Service which burned over an estimated 110,200 acres. The number of fires for the year, therefore, totaled 70, with an aggregate loss of 112,735 acres.

Service records show that there were a larger number of fires caused by lightning in 1945 than in former years, about 37 percent of the total number of fires being started by lightning, and approximately 98 percent of the total acreage consumed being due to lightning fires.

A more extensive use of airplanes for the detection of fires and the ransportation of service crews to the conflagrations is contemplated under programs formulated in the 1945 fiscal year.

PUBLIC LANDS FOR PASTURES

In the 1945 fiscal year the use of more than 12,400,000 acres of public land in the United States and Alaska for the grazing of livestock was supervised by the General Land Office as another element n its administration of the people's real estate assets. Consisting of racts in Alaska suitable for grazing purposes and similar areas in the United States not included in established Federal grazing districts, a total of 12,479,270 acres were made subject to use under 10,593 leases involving annual rental of $229,523.

In order that maximum production of meat and other livestock products might be provided from the public lands during the reconversion period, plans were being formulated at the close of the 1945 fiscal year to increase the stocking capacity of the range lands. It is estimated that with proper range facilities and improved range practices the capacity of the leased area could be increased 50 percent and an additional 10,000,000 acres leased if the improvement and rehabilitation program is carried forward to completion. Meanwhile, operations of the Range Development Service of the General Land Office, previously halted by war conditions, were scheduled for resumption as the close of the fiscal year brought an approaching end to the war.

Under the supervision of this Service improvements on the range such as the development of springs and wells, the construction of fences, the reseeding of areas denuded of vegetation, and the control of rodents and other predatory animals is undertaken in cooperation with the stockmen.

THE PUBLIC LANDS

AREA OF THE PUBLIC LANDS

The area of public lands remaining in Federal ownership, including Indian trust and tribal lands, as of June 30, 1945, amounted to about 413 million acres in the public land States and about 365 million acres in Alaska. Approximately 400 million acres of these public lands were vacant, unappropriated, and unreserved as follows: 37 million acres in the States outside of Federal grazing districts; 133 million acres within such districts; and 230 million acres in Alaska. During the year 692,000 acres were withdrawn for various public purposes while withdrawals reserving 9,497,000 acres were revoked.

Of the approximately 778 million acres remaining in Federal ownership in the States and Alaska, 118 million acres in the States and 363 million acres in Alaska were still unsurveyed as of June 30, 1945.

The total acreage patented with minerals reserved to the United States was increased during the year to 48,766,625 acres as shown on the following table:

Acreage of lands patented with minerals reserved to the United States, as of June 30, 1945

Type of mineral reservation	Patented during fiscal year 1945	Total patented through June 1945
Reservation of all minerals:		
Under Stock Raising Act	15, 094	33, 586, 052
Under other acts	50, 684	2, 376, 256
Total	65, 778	35, 962, 308
Reservation of specific minerals:		
Coal	5, 084	10, 875, 615
Others [1]	7, 342	1, 928, 702
Total	12, 426	12, 804, 317
Grand total	78, 204	48, 766, 625

[1] Includes coal reserved in combination with other minerals.

Leases and Permits

During the year an additional area of 1,793,513 acres was brought under lease, including mineral permits and licenses, making a total of 17,707,440 acres under lease at the end of the year. The types of leases in force June 30, 1945, are shown by the following tables.

Mineral leases, permits, and licenses outstanding,[1] as of June 30, 1945

Mineral	Leases		Permits		Licenses		Total	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Oil and gas	[2] 6, 969	4, 521, 486					6, 969	4, 521, 486
Coal	331	76, 190	79	66, 635	88	3, 385	498	146, 210
Phosphate	9	5, 911					9	5, 911
Potash	20	47, 292	1	2, 539			21	49, 831
Silica sands	2	400					2	400
Sodium	4	1, 629	34	53, 224			38	54, 853
Total	7, 335	4, 652, 908	114	122, 398	88	3, 385	7, 537	4, 778, 691

[1] Does not include permits granted to Federal war agencies.
[2] Does not include 25 leases within naval reserves (10,162 acres).

Leases other than mineral leases outstanding, as of June 30, 1945

Type of lease	Number	Acres	Annual rental
Aviation	43	28, 776. 27	$525. 00
Fur farm (Alaska)	19	133, 810. 00	775. 00
Grazing (Alaska)	9	1, 168, 953. 93	1, 269. 35
Grazing (Oregon and California)	212	263, 044. 01	8, 368. 08
Grazing (Taylor Act, sec. 15)	10, 584	11, 310, 316. 49	228, 254. 44
Recreational	17	20, 003. 78	[1] 610. 70
Small sites (5-acre tracts)	626	3, 091. 32	[2] 3, 080. 00
Water well	15	600. 00	585. 50
Others	3	153. 01	10. 00
Total	11, 528	12, 928, 748. 81	243, 478. 07

[1] Does not include rental of 1 lease, the rental of which is based on receipts.
[2] Does not include rental of 10 business site leases, the rentals of which are based on receipts.

In addition, 393,000 acres were being used at the end of the year by Federal and local agencies, private individuals, and corporations under permit from the Commissioner of the General Land Office. War agencies held Departmental permits for the use of almost 24,000,000 acres of public lands.

Homesteads, Sales, and Other Entries

Although the total number of entries on the public lands declined again during the year, the number of new homesteads and public auction sales increased over last year. The number of new homesteads in Alaska totaled 117, compared to 94 in the fiscal year of 1944 and 79 during 1943.

The following table shows the new entries and selections allowed, the entries finally approved and the patents and certifications issued during the year. At the end of the year, 4,156 entries embracing 626,000 acres were pending awaiting further compliance with the public land laws by entrymen or final action by the General Land Office.

Entries and selections, fiscal year 1945

Type of entry or selection	Original entries and selections [1]		Final entries [1]		Patents and certifications [1]	
	Number	Acres	Number	Acres	Number	Acres
Homestead entries:						
Stock raising	------	----------	26	12,711.18	32	15,094.37
Enlarged	8	2,162.83	11	2,622.27	11	2,799.81
Reclamation	[2] 17	2,133.50	[5] 118	12,715.49	158	16,458.66
Forest	3	178.73	3	197.67	7	530.98
Commuted	------	----------	[6] 11	1,064.95	[8] 3	366.59
Sec. 2289 R. S., et al	157	18,218.69	[7] 80	8,086.58	[9] 68	6,872.43
Total homestead entries	185	22,693.75	249	37,398.14	279	42,122.84
Other entries and selections:						
Desert land entries	13	1,280.82	22	2,333.58	30	3,961.50
Public auction sales	------	----------	149	13,058.34	110	9,454.01
Timber and stone entries	------	----------	1	40.00	3	98.60
Mineral entries	49	6,487.87	87	6,095.33	58	5,814.49
Indian selections	------	----------	------	----------	103	551.04
Miscellaneous cash sale entries	2	(4)	230	2,126.04	139	8,571.27
Exchanges	------	----------	------	----------	160	72,389.57
State selections	25	9,802.18	------	----------	24	[10] 72,226.59
Curative and supplemental patents	------	----------	------	----------	174	(11)
Others	(3)	0.73	8	306.27	80	1,773.19
Total other entries and selections	89	17,571.60	497	23,959.56	881	174,840.26
Grand total	274	40,265.35	746	61,357.70	1,160	216,963.10

[1] An original entry or selection is one made in pursuance of an act of the Congress which prescribes the terms and conditions under which patent may be issued or other evidence of title granted. An original entry becomes a final entry upon compliance by the entryman with further requirements of the law, such as residence or additional payment, and upon the issuance of a final certificate. A final certificate shows that, in the absence of irregularity, the entryman is entitled to a patent and passes equitable title to the land to the entryman. Where upon final examination it is found that an entry or selection is in proper form and that the law has been complied with, a patent conveying legal title to the claimant is issued. In the case of certain State selections, the legal title is conveyed upon approval thereof by the Secretary of the Interior and upon certification by the Commissioner of the General Land Office.

[2] Includes 3 homesteads on ceded Indian lands (433.60 acres).

[3] One selection was amended.

[4] Town lots upon which only part payment was made; area not tabulated.

[5] Includes 4 homesteads on ceded Indian lands (400.00 acres).

[6] Includes 9 homesteads on ceded Indian lands (759.94 acres).

[7] Includes 14 homesteads on ceded Indian lands (1,240.90 acres).

[8] Includes 1 homestead on ceded Indian lands (80.00 acres).

[9] Includes 3 homesteads on ceded Indian lands (280.75 acres).

[10] Includes certifications, 47,963.15 acres.

[11] Acreage previously reported.

Land Grants

Title to 73,765 acres was conveyed during the year in satisfaction of grants of public lands made by the Congress to States and railroads for public purposes. Grants to States included 43,237 acres of indemnity school land selections, 14,983 acres of park selections, 9,280 acres of swamp land, and 4,726 acres selected for miners' hospitals. A total of 1,539 acres was patented to railroad companies pursuant to the Transportation Act of 1940. In addition, 16 patents were issued to States to give them additional evidence of title to 407,833 acres of previously granted school lands.

A total of 218 applications for rights-of-way were approved during the year under laws which provide for the granting of rights-of-way over the public lands for telephone and telegraph lines, public roads, pipelines, and other purposes. Of the applications approved, 104 were permits or easements with an annual rental of $1,730 and 32 were temporary rights-of-way over "O. and C." lands with an annual rental of $160.

Land Exchanges

Exchanges of land with private owners and local governments resulted in the addition of 56,087 acres to grazing districts in exchange for 51,954 acres of Federal land; 9,037 acres to Indian reservations in exchange for 9,079 acres; 480 acres to the "O. and C." lands in exchange for an equal acreage; and 197,395 acres to national forests in exchange for 10,877 acres of land and sufficient timber to equalize the values involved.

RECEIPTS AND EXPENDITURES

Receipts from all sources during the year totaled $13,381,653. Mineral rentals, royalties, and bonuses accounted for 82 percent of the total receipts and sales of timber from the Oregon and California and Coos Bay lands for an additional 13 percent. The remaining 5 percent were realized from sales of public and ceded Indian lands, rentals, fines and penalties, copying fees, and from miscellaneous sources.

Of the total receipts, 38 percent will be distributed among various State and county governments and 44 percent will be covered into the reclamation fund. The remainder, except for $10,384.58 which will be credited to Indian trust funds and $57,734.66 which will be credited to the range improvement fund, will be covered into the general fund of the Treasury.

Expenditures from appropriations amounted to $2,365,005 distributed as follows: general administration, $867,783; surveys, $517,297; field examination, $343,482; administration of the revested and reconveyed grant lands, $290,956; district land offices, $267,925; range improvements, $44,275; and fire control in Alaska, $33,287. Expenditures, aggregating $319,191, were made from funds transferred to the General Land Office for the emergency protection of public lands and for soil and moisture conservation operations.

The following table shows the receipts earned during the year, by sources and Treasury accounts.

Disposition of receipts of the General Land Office:[1] fiscal year 1945

Source of receipts	Covered in the Treasury earmarked for—				
	General fund	Reclamation fund	States and counties	Indian trust funds	Total
Sales of public lands	$79, 582. 17	[2] $100, 000. 00	[2] $3, 800. 00		$183, 382. 17
Fees and commissions	17, 359. 71	[2] 61, 000. 00			78, 359. 71
Mineral leases and permits:					
Mineral Leasing Act	1, 005, 976. 36	5, 281, 375. 89	3, 772, 411. 35		10, 059, 763. 60
Red River oil and gas lands			3, 399. 75	$5, 666. 24	9, 065. 99
Potash	68, 098. 61	[3] 410, 095. 34	255, 369. 79		733, 563. 74
Other	[4] 216, 604. 10				216, 604. 10
Total mineral	1, 290, 697. 07	5, 691, 471. 23	4, 031, 180. 89	5, 666. 24	11, 018, 997. 43
Oregon and California grant lands	867, 094. 56		867, 094. 57		1, 734, 189. 13
Coos Bay grant lands	15, 433. 74		[2] 15, 000. 00		30, 433. 74
Taylor Act grazing leases	57, 734. 66	[5] 57, 734. 66	115, 469. 32		230, 938. 64
Rights-of-way leases	31, 977. 49	444. 51			32, 422. 00
Sales of reclamation town lots		[6] 7, 498. 64			7, 498. 64
Sales of Indian lands				4, 718. 34	4, 718. 34
Copying fees	21, 103. 63				21, 103. 63
Miscellaneous	39, 609. 46				39, 609. 46
Grand total	2, 420, 574. 49	5, 918, 149. 04	5, 032, 544. 78	10, 384. 58	13, 381, 652. 89

[1] Before final settlement of all accounts by the General Accounting Office.

[2] Estimated.

[3] Includes $52,577.64 collected in California under act of Oct. 2, 1917 (40 Stat. 297).

[4] Includes $23,767.94 collected in Wyoming under act of June 26, 1926 (44 Stat. 1621), $176,868.94 collected in California under Executive Order 9087 dated Mar. 5, 1942, and $15,967.22 collected in Alaska.

[5] Range improvement fund.

[6] Includes $112.50 from sale of reserved reclamation lands.

Office of Land Utilization

LEE MUCK, ***Assistant to the Secretary***

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RECONVERSION in a broad sense means the return of the Nation as expeditiously as possible to the pursuits of peace. For the Department of the Interior it points to the need of an inventory of those national assets for the management of which we are directly responsible; a determination as to the extent of the depletion of these assets which may have occurred as a result of the war; and the preparation of plans which will insure a maximum restoration of the impaired values and the development of a sustained national economy. The basic wealth of the Nation, represented in large measure by its soils and waters, forests, and pasture lands, has been drawn upon as never before to provide the essentials of war that brought victory to the United States and its allies after five destructive years. Reconversion to a sound peacetime economy following the war and its attendant heavy drain upon the natural resources of the Nation therefore presents a problem and a challenge to the Department in the field of land and resource management.

The problem and the challenge involved in reconversion place a responsibility upon the land and resource management agencies of the Department to provide a more fully coordinated and integrated management program by virtue of which the lands and resources under their respective jurisdictions will be so administered as to insure the greatest possible returns to society in the years ahead.

The value of cooperation and of coordinated and integrated action to secure desired results was most clearly demonstrated during the war. The principles involved were not new but the successful application thereof under so many and such varied conditions constituted a complete demonstration of the importance of unified action in the conducting of operations. If the same cooperative approach is applied to the solution of the problems of peace, the future of the Nation is assured, regardless of the serious drain on its natural resources.

The land and resource management problem facing the bureaus and agencies of the Department of the Interior in reality is not one problem but many problems, all closely related and having a distinct bearing on the successful establishment of peacetime economy. The complexity and interrelation of land and resource management problems which exists has been recognized in the Department for many years and finally brought about the establishment of the Office of Land Utilization in the year 1941 with a view to evolving a unified conservation program. In the interim much has been accomplished, but much more remains to be done to coordinate and integrate fully and effectively the operations of the respective bureaus and agencies of the Department and to secure effective cooperation with other governmental agencies operating in similar land-use fields.

While major attention during the past 4 years has been directed to winning the war, nevertheless the long-time problems of peace have not been neglected, and marked accomplishments have been made in several important lines of cooperative endeavor, namely:

1. The development of a Nation-wide soil and moisture conservation program on lands under the jurisdiction of the Department of the Interior.
2. The coordination of the forestry activities and the development of a more effective forest and range protection program.
3. The clarification and reorientation of the land-use policies of the Department and the establishment of sound land-classification procedures.
4. The organization of the Water Resources Committee which is charged with the responsibility of acting for the Department and its agencies on problems affecting the water resources of the Nation.
5. The rendering of advisory service looking to the solution of numerous day-to-day management problems that constantly arise in a Department with highly diversified activities.

The encouraging results accomplished were made possible through the application of a high level of functional coordination and the integrating and reconciling of divergent views, experiences, and judgments in the field of land administration. The objectives sought were attained through cooperative efforts and the dissemination of information with respect to operating programs and practices and through the rendering of technical service on management problems. The practical application of these administrative principles and the degree of success achieved in the several fields in which they were applied are hereafter set forth.

SOIL AND MOISTURE CONSERVATION OPERATIONS

The Soil and Moisture Conservation program of the Department of the Interior is an integrated and coordinated program conducted through the land-management agencies of the Department on the Federal lands under their respective jurisdictions. It is a segment of the national soil conservation program, the other parts of which are conducted by agencies in the Department of Agriculture. It has for its purpose the correction of soil erosion and water losses occurring on approximately 60 million acres of land widely distributed through the various States in which there are public lands. The principal areas on which soil and moisture conservation operations are being performed comprise portions of the various river basins lying west of the Mississippi River and largely west of the Rocky Mountains.

Within each of these river basins there are land areas administered by some one or more of the land-management bureaus of the Department. For example, in the Snake River Basin—a tributary of the Columbia—there are national parks and monuments, fish and wildlife refuges, Indian lands, reclamation projects, grazing districts, and unappropriated and unreserved public domain areas. An orderly, integrated plan of soil and moisture conservation on Federal lands under the jurisdiction of the Department of the Interior in the Snake River drainage basin requires that the Department exercise supervisory authority over conservation operations in the whole area in order to insure that the various land-management agencies perform soil and moisture conservation operations within the basin that are essential to the correction of the situation as a whole. These operations are further coordinated with the management responsibilities of the agencies concerned in order that full value may be obtained from the restoration and management work performed. Furthermore, since there are intermingled lands in private ownership within the basin, and also lands under the administration of other Federal and State agencies, it is necessary that the Department of the Interior conservation program be coordinated with the programs of these other agencies. Specific reference in this connection is made to the State soil conservation districts operating under State law with the advice and aid of the Soil Conservation Service, Department of Agriculture, and the general program of the Forest Service, also in the Department of Agriculture.

The problem is a complex one from any angle. The task of restoration under the best of circumstances is difficult. The complex land ownership pattern and the conflict of interests and uses tends further to complicate the situation.

The Office of Land Utilization determines the over-all program in the areas where operations are to be conducted, harmonizes and compromises any differences that may develop, and provides for a maximum amount of assistance necessary to secure correction of erosion and water losses. To this end, advice and assistance are given to the agencies concerned regarding the conditions and circumstances under which projects may be established, the type and character of work to be performed, and approval of the expenditures to be incurred. Under this program attention can be, and is, directed toward the correction of conditions on the more critically eroded areas of Federal lands and the operations performed are those of proved value as demonstrated heretofore under like soil and other conditions.

Wherever possible the securing of a maximum amount of cooperation from the users of the lands is urged, for, while the lands are exclusively or primarily in Federal ownership, the users who are dependent thereon for a livelihood have a definite interest in their reconstruction and improvement. This cooperative feature constitutes a further coordination of the soil and moisture conservation program which facilitates and hastens the corrective procedures while providing more definite assurance against recurrence of the destructive processes that have heretofore occurred. The constant pressure by the Department in this matter of cooperation has resulted in a year-to-year increase in the amount of such cooperation, until at the present time the amount contributed is almost equal in value to the appropriations authorized by Congress for soil and moisture conservation operations on the Federal lands.

The soil and moisture conservation program of the Department comprises operations on 500 project areas scattered through 30 States, embracing a total area of approximately 60 million acres. It has been determined that of this total between 10 and 12 million acres can be classed as being in a serious or critically eroded condition. Approximately 20 million acres in addition should receive some attention from a soil and moisture conservation standpoint, with the remaining 30 million acres largely in the twilight zone where material benefits from a conservation standpoint can be obtained without too large expenditures, provided the lands and resources are properly managed.

FOREST CONSERVATION

In the field of forest conservation the program of the Office of Land Utilization has been mainly directed toward the accomplishment of three specific objectives:

1. The securing of adequate protection for the forest and range resources administered by the Department.
2. The development of the sustained-yield principle in the management of the forest resources under the jurisdiction of the Department.
3. The formulation of a sound plan of management for the forests of the interior of Alaska.

In the field of protection the Office of Land Utilization rendered advisory service to the agencies concerned in more fully and adequately presenting to the Congress the whole forest protection problem on the 400 million acres of forest, brush, and grass lands under management in the continental United States and Alaska. Appropriations made available during the past 4 years have more than doubled and, while not yet sufficient to provide adequate protection for all of the lands in need thereof, the several agencies concerned are better organized and better prepared than ever before to protect the public lands from the ravages of fire, insects, and disease. As concrete evidence of progress in this direction, it should be noted that the area burned over in the continental United States has been reduced from 1,879,613 acres in the calendar year 1942 to 552,235 acres in the calendar year 1944; and in Alaska, from 4,500,000 acres in 1940 to 110,603 acres in 1944.

Cooperative work carried on with the Bureau of Entomology and Plant Quarantine, Department of Agriculture, in which the Office of Land Utilization acts in a supervisory capacity, has brought about the coordination of white pine blister rust control operations designed to protect the valuable five-needle pines from the white-pine blister rust. Control work has been definitely advanced on the national parks, Indian reservations, and the Oregon and California revested grant lands. At the close of operations last December, a total of 363,000 acres out of the 728,000 acres of white pine lands under the jurisdiction of the Department had been covered by the preliminary eradication of the species of brush responsible for the spread of the disease. Plans are in preparation involving expanded and more intensive operations looking to the control of infections that are a constant menace over large areas of land, portions of which are under the jurisdiction of the Department.

Sustained yield of forest resources contemplates improvement in conditions of growth, management of the timber stand, and utilization of the timber crop in ways that will permit and sustain the entire economy built around the lumber industry. The Office of Land Utilization participated during the preceding year in the preparation and presentation to the Congress of information relating to the values inherent in the sustained-yield principle. The representations made in this connection by Federal, State, and private agencies resulted in the enactment of the cooperative sustained-yield forest management act of 1944, authorizing the Secretary of the Interior and the Secretary of Agriculture to establish sustained-yield units either directly or in cooperation with other forest land owners. A general statement of policy with respect to the administration of this law was formulated by the Department for the guidance of the agencies concerned. Marked progress was also made in the application of the sustained-yield principle under the O. & C. Act of 1937, and a form of cooperative agreement was worked out by the General Land Office and the Office of Land Utilization.

The major forward step taken by the Department in the field of forest conservation during the year 1944 was the securing of a regular appropriation of $147,460 "For the administration and management of forest resources, including the prevention and suppression of fires on the public domain in Alaska, * * *." This appropriation will make possible the setting up of administrative machinery, under the direction of the General Land Office, which will insure the protection and management of these vast resources of the interior of Alaska for the first time since the Territory was acquired from Russia. It means for Alaska, and for the Nation, the protection of these forests from fire and the establishment of sound forestry practices in connection with the development thereof.

The timber sale operations conducted on the lands under the jurisdiction of the Department normally constitute a business amounting to more than 3 million dollars in value and reflect a timber cut of over a billion feet a year. War demands continued at a high level during 1944 and, as a result, a large number of timber contracts were considered and approved by the Department.

LAND CLASSIFICATION AND LAND POLICY

During the year 1944 a study was conducted of the land-classification activities of the General Land Office and the Grazing Service, and recommendations were made for coordination and expedition with respect to these activities. A draft statement for the Departmental Land Policy Committee on the land-management policies of the Department was completed and submitted to the Department for final consideration. Land-administering agencies of the Department were kept informed concerning surplus real property in which such agencies might have an interest, and a survey was initiated looking to the compilation of a list of surplus areas suited for addition to existing administrative units. About 1,500 applications involving the disposal, lease, or permitted use of public lands were reviewed. Many of these cases were on appeal or otherwise involved controversial issues and required most careful consideration before recommending action. The General Land Office was assisted in preparing a statement of conservation policy with respect to the sale of isolated tracts of the public domain, and the statement was issued as Departmental Order No. 1973, under date of August 4, 1944.

CIVILIAN PUBLIC SERVICE CAMPS

The Office of Land Utilization continued to act in a liaison capacity between the Selective Service System and the bureaus of the Department of the Interior in the operation of the civilian public service camps during the year 1944. These camps, which provided work of national importance in the protection and conservation of natural resources—including fire, insect, and disease control and water conservation projects—were under civilian direction and were manned by persons who, by reason of religious training or belief, conscientiously opposed participation in the war.

At the close of the year, 10 civilian public service camps were operating on Department of the Interior lands: 5 on the national parks, 3 on reclamation projects, 1 on the O. & C. lands of the General Land Office, and 1 on a national wildlife refuge. The Seney National Wildlife Refuge camp, located in the State of Michigan, was abandoned on June 1, 1945.

WATER RESOURCES COMMITTEE

The staff work of the Water Resources Committee, established by departmental order dated May 2, 1944, was conducted by the chairman and the executive officer during the fiscal year just passed. The objective sought by the Committee is to insure the coordination of water-development programs within the Department in order that full recognition may be given to the over-all benefits to the Nation.

In carrying out its stated functions, namely, the assembly and dissemination of essential information concerning water-development programs, the following work was accomplished by the Committee:

1. Sixteen formal meetings were held; and the executive officer represented the Committee at 12 meetings of the Federal Interagency River Basin Committee.

2. Recommendations designed to promote cooperation and coordination at the field level were submitted to, and received the approval of, the Secretary.

3. Consideration was given to a number of project and basin reports of agencies within the Department and the War Department, and definite recommendations were made thereon.

4. Detailed information concerning water projects, laws, policies, and related features was assembled and made available to the interested agencies of the Department.

5. Operating procedures looking to the coordination of the water-development and water-conservation programs of the Department were established.

The progress made in the coordination of the water-development programs of the Department of the Interior has been encouraging, and the procedures laid down by the Congress in the Flood Control Act of 1944 and the Rivers and Harbors Act of 1945 have greatly strengthened the cooperation between the Federal agencies and the States. However, much remains to be accomplished before the degree of coordination essential to sound management in this complicated field can be fully attained.

PRINCIPLES OF COORDINATION

Experience in the Department of the Interior during the past several years has clearly demonstrated the value of effective coordination and close cooperation in the field of land and resource management. It seems obvious also that the coordination of conservation activities of a Department organized on a bureau basis can be secured by devices less drastic than complete centralization and that a common plan of action which cuts across structural lines in the pursuit of an over-all interest is possible of attainment without seriously disrupting well-established bureau organizations.

The Office of Land Utilization, since its creation in 1941, has proceeded on the theory that the application of the fundamental principles of coordination and cooperation can be effected without overlapping or duplication and without interfering with the administrative authorities of the bureaus operating in the various functional fields. It has earnestly sought to promote a unification of action directed towards a common goal through cooperative efforts, the dissemination of information, and the rendering of efficient advisory service. The methods pursued have proved to be reasonably successful and have operated definitely in the public interest. It seems clear that the time has arrived when these principles of administrative management should be extended to all agencies operating in the conservation field, for the effective use and development of the basic wealth of the Nation—its soils and waters, its forests and pasture lands—will not be at its best until all interests involved have fully coordinated their responsibilities and activities.

Grazing Service

C. L. FORSLING, *Director*

* * *

UNDER the administration of the Federal range, as provided by the Taylor Grazing Act, the surface resources of the grazing districts on most of these public lands were in as good condition at the close of the fiscal year as they were at the beginning of the war, or better. At the same time they made their contribution in meeting the Nation's needs for war. This is in sharp contrast to the First World War when increased numbers of livestock, on the then unregulated, open public range, which, under the circumstances, did not contribute materially to food supplies during the war, resulted in overstocking that added to the already serious degree of depletion of the forage and soil resources.

The aim of the administration of the grazing districts is twofold; namely, the protection, improvement, and proper utilization of the natural resources on these lands and the stabilization of the livestock industry dependent upon them. These public lands, together with the non-Federal lands associated with them, continued during the past year to contribute to the Nation's needs of food and fiber, without material injury to their permanent productive capacity. While the Federal range on the whole is still far below its potential production capacity, due to past overuse and fire, extensive areas actually improved in condition as the result of weather conditions above the average, coupled with regulated use.

Nearly 40 percent of the range land in the 11 Western States is situated within grazing districts. Somewhat more than half of this is Federal land; the remainder is in private, State, and county ownership. Associated, both physically and economically, these grazing lands and the intermingled crop lands are the foundation of numerous livestock producing enterprises. Although range land makes large contributions by providing grazing for livestock and big game, its problems are closely related to those of other resources among which are water, wood, crop lands, and recreational use.

Settlement of public land under the homestead pattern of earlier years was reached and over-run during the aftermath of the First World War. New frontiers now lie chiefly in managing the remnant of the former vast public domain so that it may be put to its highest use and fitted into the over-all land-use economy of each locality. The benefits to be derived are shared by the range users, local communities, and the public.

The war has also emphasized the importance of the Federal range in the training of air and ground troops, the testing of machines, precision instruments, and explosives, and in perfecting techniques of modern warfare. A total of approximately 14,500,000 acres was so utilized. Through cooperation with the War and Navy Departments it was possible for certain of the affected lands to be grazed at the proper time without interference with their use for military purposes. In other instances it was necessary to exclude livestock. One withdrawal in New Mexico, for example, involved the removal from grazing district land of 8,421 cattle, 618 horses, 12,432 sheep, and 10,861 goats belonging to 47 permittees. In still other instances, through special arrangement with the military services, it was possible to provide alternate grazing during the war period for nearly 500,000 sheep and 16,000 cattle on areas set aside for war purposes in several States.

First among the resources and values of the Federal range are the plant cover and the soil. Their protection and improvement are basic to all other uses and values and particularly to the sustained yield of forage for grazing animals. Of equal, if not of greater importance, is the relation of these lands to water supply for irrigation and other purposes. Numerous individual ranches and farms, as well as communities, obtain their water supplies directly from these lands. In addition the Federal range and associated lands contribute more or less run-off to streams which are the source of supply to distant towns, cities, and irrigated fields. Water is so important in the West that it is imperative that watershed lands be maintained in a condition to yield the maximum quantity and quality of water. Silt-laden reservoirs and clogged streams or irrigation canals are a direct concern to irrigation, industry, and commerce, as well as to the farmer at the far end of the ditch. Maintaining adequate plant cover conditions is the key to adequate watershed protection.

Thousands of families obtain fuel, fence posts, farm timbers, and rough lumber from the 23 million acres of woodland and forest on the Federal range. No detailed survey has ever been made of the forest and woodland growth. Assuming, however, that the areas classified as woodland and forest contain an average of 10 cords of wood to the acre, there are 230 million cords of wood in grazing districts. In addition to the foregoing there are special use values, such as rights-of-way, home and business sites, recreation, and sites for commercial photography.

No adequate survey has ever been made to determine the value in terms of dollars and cents of the surface resources of the public land in grazing districts. Any attempt to do so at this time, therefore, must be based upon many assumptions. It may be assumed, for example, that 144 million acres of grazing land have an average value of $1.25 an acre for soil and forage. The estimated 230 million cords of wood are considered to have a value of 50 cents a cord.

Many factors enter into the problem of attaching a tangible cash value to these lands for watershed purposes. What is the value of a watershed, for example, to a community which derives its domestic water supply from it? What protection values may be assigned to a given area for the control of floods, the prevention of the deposition of silt in streams and reservoirs, or the abatement of dust storms? Certain areas rank high in these respects and at the other extreme, certain other areas have practically no watershed value. Hence, the dollar value of watersheds, ranging from $12 or $15 an acre or more in some localities to nothing in others, may be arbitrarily set at $1 an acre for the 144 million acres of Federal range.

It would be difficult to estimate the value of the public lands for training and testing grounds and the parts these lands played in winning the war. Had the Federal Government been obliged to purchase the 14½ million acres of public lands used for war purposes, a considerable item would have been added to the cost of the war. The availability of these lands for war purposes and for special uses as home sites, commercial photography purposes, rights-of-way, and stock driveways, for which the Federal Government derives revenue, is arbitrarily placed at $52,000,000.

In addition to the foregoing, range improvements placed on the Federal range at public expense during the past 10 years, consisting of 17 major types, are estimated to have a residual value of $10,000,000.

On the basis that has been outlined, the capital value of the 144 million acres in the custody of the Grazing Service may be tabulated as follows:

Soil and forage at $1.25 an acre	$179, 000, 000
Watershed at $1 an acre	144, 000, 000
Woodland and forest, chiefly woodland, at 50 cents a cord	115, 000, 000
Range improvements	10, 000, 000
Special uses	52, 000, 000
Total	500, 000, 000

In undertaking to rehabilitate the range and stabilize its use, the Grazing Service generally has had the active support and cooperation of the users themselves, including the district advisory boards. A much greater interest and concern in the condition of the range on the part of the stockmen is noticeable as compared to a decade and a half ago. The Grazing Service is hopeful that the willing cooperation of the range users, who, after all, are most vitally concerned in maintaining and improving forage production on the range, will bring about, within practical time limits, the further adjustments that may be needed wherever necessary to stop further range deterioration and to turn the trend in favor of range rehabilitation.

In addition to rehabilitation, extensive further development of the range is needed to facilitate range administration, promote its full economic utilization, make possible better handling of livestock, and improve the quantity and quality of the resources. Needed projects include water developments, fencing, construction of roads, trails, and telephone lines, rodent control, the installation of improvements for fire control, soil and moisture conserving structures and improvements of the forage cover by both natural and artificial reseeding.

The forage cover, and hence the grazing capacity, can be improved within justifiable economic limits on literally millions of acres of the Federal range by mechanical treatment and reseeding. The presence of thrifty sagebrush, for example, which occurs on millions of acres of land, is indicative that soil and moisture conditions are ample for the production of a good forage cover. Over extensive areas the sagebrush has thickened to an extent that the better forage plants have been greatly reduced or almost entirely eliminated. By the judicious use of controlled burning or breaking down the sagebrush with heavy equipment, the land can be freed of sagebrush in a manner to permit the growth of grasses and other forage plants. Where the remaining native forage plants are insufficient to revegetate the land naturally, reseeding will be necessary. A vast opportunity lies ahead in this line of endeavor in the grazing districts. The same is true also for extensive areas of nonsagebrush land needing rehabilitation.

The Grazing Service has presented estimates for a postwar conservation program for use especially in the event that an emergency employment program should become necessary. Employment under this program, in addition to the unskilled labor, would include engineers, draftsmen, range technicians, carpenters, drillers, truck drivers, tractor operators, dragline operators, and many other types of skilled labor.

Since the areas where the work is proposed are remote from centers of population and the projects variable in size and character, it would seem feasible to operate from work camps to be distributed over the territory. This will likewise be attractive to local citizens who seek employment within reasonable proximity of their homes. The plan contemplates construction of 150 portable camps with facilities to accommodate 100 men at each camp.

The backlog of work in sight is estimated to require 67,000 man-years or full employment of 20,000 men for 3½ years at a total cost of $191,422,500. Of this total, the amount of $50,714,500, about 26 percent, is estimated on the basis of actual needs of the range, to be in the interest of the livestock industry, and predicated on increased forage production values which would compensate for the carrying costs of the investment. The balance is considered to be a responsibility of the Federal Government to rehabilitate, preserve, and protect the capital values inherent in the land and its resources in the public interest.

RANGE ADMINISTRATION

Forage conditions during the year were, on the whole, better than average during the previous year but extreme drought persisted in localized areas causing some losses. The grazing load in terms of permitted animal units declined 1 percent while the numbers of permitted livestock decreased 6 percent from 10,694,305 to 10,019,178 head. There were 725,464 fewer sheep, but 86,174 more cattle during 1945 than in 1944. For the first time in grazing district history the number of permitted cattle exceeded 2,000,000 head.

Ranch sales involving grazing preferences on the Federal range and transfers of privileges under the Federal Range Code reached a new high during the year. Livestock generally were in good condition and with the current high prices and consumer demand the users were encouraged to cut down their numbers, especially cattle, as a means of providing for the dry years which, according to experience, inevitably lie ahead. Losses of forage caused by trespassing stock and range fires are still excessive. This situation cannot be corrected fully until adequate manpower on the ground is available to patrol and supervise the area.

The grazing district advisory boards are an important part of the Grazing Service organization. Their cooperation in lending advice on range problems, improvement, wildlife protection, and economic conditions within the industry aided materially in the administration of grazing districts during the eleventh year of their participation in the program.

Recheck of grazing capacities and proper seasons of use and the reexamination of many dependent properties are recurrent jobs. The ultimate goal of properly stocked ranges subdivided into units or allotments, to be utilized under term permits by all who are entitled to share in the use of the range has not been wholly achieved.

Only two-thirds of the authorized users are operating on a term-permit basis although most of the licensees and permittees can now plan their year-to-year range operations with reasonable assurance, subject, of course, to the variable weather conditions and other unforeseen factors, including needed adjustments which will be necessary in some cases upon completion of range surveys and base property inventory.

GRAZING FEES

In regard to the fees to be charged, section 3 of the act provides: "That the Secretary of the Interior is hereby authorized to issue or cause to be issued permits to graze livestock on such grazing districts * * * upon the payment annually of reasonable fees in each case to be fixed or determined from time to time." Grazing fees of 5 cents for cattle and horses per month and 1 cent for sheep and goats were established in 1936 when the livestock industry was beginning to recover from drought and depression and when grazing districts were new. During the year consideration was given to increasing the grazing fees pending the completion of a comprehensive range appraisal. This matter was first broached to the National Advisory Board Council in November 1944. Since then and up until September 10, 1945, further study and 10 hearings on the matter have been conducted by the Senate Committee on Public Lands and Surveys, in Washington, D. C., and 8 of the Western States. Recommendations on the fees by the Director are being delayed until the facts presented at the hearings and obtained through various studies have been fully analyzed.

LICENSES AND PERMITS

Due to transfers, liquidation, and suspension of emergency licenses there was a reduction of licenses and permits issued during the year from a total of 22,562 in 1944 to 21,650 in 1945, a difference of 912. Livestock use the range under licenses and permits at various periods during the year. The statistical detail is shown by regions in table I at the end of the chapter.

Big game numbers in grazing districts represented by 11 major species totaled 583,432 head. A proper distribution of game animals over the range generally has not been achieved and, as a consequence, many "sore spots" exist where game is concentrated to the detriment of both game and forage.

Approximately 20,000 excess horses were removed from the range during the year. Action under the Secretary's orders of March 16, 1943, and January 29, 1944, resulted in the removal of about 100,000 surplus horses from grazing districts and adjacent lands during the past 3 years. Steps are needed to encourage purchase and shipment of excess horses by appropriate agencies for food and farm purposes in devastated countries.

RANGE SURVEYS

Extensive range surveys were accomplished on 2,065,964 acres in four regions. On 1,051,661 acres previously surveyed the grazing capacities were checked in preparation of range management plans. In connection with the allocation of range privileges in one district, 3,819,697 acres were surveyed on a reconnaissance basis. Approximately one-third of the above acreage is within approved soil and moisture conservation projects. Property examinations were made on 1,839 cases during the year. An estimated job load of 17,959 such cases exists in 60 grazing districts of which 13,673 have been examined to date, only one-third of which are completed to required standard. The appropriate decision as to the relative claims of about 5,000 bona fide applicants for range privileges is still tentative and unsettled. This program should be augmented in order to achieve the conservation objectives of grazing districts.

HEARINGS AND APPEALS

During the fiscal year 1945, 100 appeals from decisions of the local administrative officers were filed, 86 of all pending appeals being disposed of by cooperative actions between the appellants and district graziers or through formal hearings and decisions of examiners. Ten examiners' decisions were appealed to the Secretary.

LAND PLANNING AND UTILIZATION

Fundamental in the conservation program is a policy which will fit the complexities of land ownership within grazing districts into manageable units whereby the land can be properly administered and the greatest benefits will accrue to both public and private lands. This is accomplished mainly through exchange of lands, exchange of use, cooperative agreements with States, counties, and individuals, and by leasing lands within the boundaries of grazing districts under the Pierce Act.

Land planning in grazing districts to improve the pattern of ownership was undertaken and considerable progress has been made during recent years. Detailed plans involving a long-time program of exchange, blocking and negotiation were submitted for review. One of the most effective means of coordinated land administration in areas of mixed ownership is through cooperative agreements with the individuals, groups, or agencies affected. A number of such agreements were inaugurated during the year and many that were entered into during previous years were continued.

COOPERATION WITH MILITARY SERVICES

At the end of the fiscal year 14,403,302 acres of public land in grazing districts were involved in military withdrawals and use permits representing a reduction of 25,617 acres from the amount used for such purposes during the previous year. Major military uses of public lands include testing ranges for bombing, aerial gunnery, machine-gun practice, and areas for airfields, airports, landing fields, tank corps maneuver grounds, proving grounds, storage dumps, and depot centers. Also lands were provided the War and Navy Departments, the Defense Plant Corporation, the Civil Aeronautics Administration, and the Federal Housing Authority for rights-of-way, telephone lines, water-pipe lines, landing strips, and airfields.

Other activities in connection with the war program included the consideration of applications for timber, involving millions of board feet, in grazing districts under the act of June 5, 1942 (Pub. Law 586, 77th Cong.). Assistance was given to military services in the appraisal of nonpublic lands listed for lease, purchase, and condemnation.

STATUS OF GRAZING DISTRICTS

Grazing districts total 60 in number, there having been no change during the year. However, modification orders, withdrawals, and revocations involving public lands mainly for reclamation and military purposes caused many internal changes in grazing districts, resulting in the addition of about 5,000,000 acres of all categories of land to the total area administered during the previous year. The statistical detail of grazing district acreage is shown on table II at the end of the chapter.

LAND CLASSIFICATION

At the beginning of fiscal year 1945, 283 individual land cases were pending within grazing districts under sections 6, 7, 8, and 14 of the Taylor Grazing Act; the 5-acre-tract law of 1938; and other public-land laws. A total of 783 new cases were received, 671 were disposed of, and 395 were pending at the close of the year.

PIERCE ACT LEASES

Favorable economic conditions of recent years have created an active demand for non-Federal grazing lands as well as for crop lands within the boundaries of grazing districts. As a result, much of the State and county-owned land formerly leased under the Pierce Act was sold or leased to individuals. The area of Pierce Act leases at the end of the year totaled 928,500 acres in 6 States.

APPROPRIATIONS AND ALLOTMENTS

Administrative funds provided by Congress for the fiscal year totaled $1,047,740. Of this amount $119,630 was for fire suppression and presuppression leaving $928,110 for grazing district administration. In addition $115,000 for construction and maintenance of range improvements, and $8,500 for leasing of lands under the Pierce Act were available from direct appropriations. Allotments for emergency fire fighting totaled $125,000 and for soil and moisture conservation work $492,500. Advisory boards contributed $77,115.83 for range improvements. The Public Roads Administration transferred to the Grazing Service $520,500 for construction and maintenance of access roads to mineral deposits and other war material in eight States.

FEES COLLECTED AND DISTRIBUTED

Earned grazing fees during the year totaled $765,382.35, of which $211.93 was deposited to the credit of Indians in Arizona and $382,585.24 was paid to 10 Western States for expenditure under State law. Grazing fee income for the year by States with the respective amounts paid to States shown in parentheses, are summarized as follows: Arizona $40,059.14 ($19,923.60); California $19,767.67 ($9,883.81); Colorado $51,503.65 ($25,751.84); Idaho $77,851.91 ($38,925.98); Montana $52,961.47 ($26,480.71); Nevada $118,411.97 ($59,206); New Mexico $118,277.65 ($59,138.80); Oregon $52,035.92 ($26,017.97); Utah $133,079.86 ($66,539.95); Wyoming $101,433.11 ($50,716.58). Earned fees in grazing districts for the 10-year period ending June 30, 1945, now total $6,927,036.03, of which $3,444,632.58 have been paid to the above listed States under provisions of the Taylor Grazing Act.

The Service continued to be hampered by a large personnel turnover, mainly in field and clerical positions. This affected chiefly the district and regional offices and reduced materially the output and the quality of pressing work. Excessive time of supervisory personnel was required in training new employees. Many costly delays in work programs were experienced due to lack of repair facilities and scarcity of materials and parts.

RANGE IMPROVEMENT

During the war the Grazing Service has maintained a policy of limiting its construction program to projects that were absolutely necessary to aid the production and handling of livestock on the range. Only 651 stock-water developments, 342 miles of truck trails, 125 miles of stock trails and driveways, and 390 miles of fence were built. On the other hand, strong emphasis was placed on the maintenance of range improvements previously constructed.

A summary of range improvements with accumulative totals is shown on table III at the end of the chapter.

SOIL AND MOISTURE CONSERVATION

Soil and moisture conservation activities were conducted on 55-project areas. Nine additional project areas were added during the year resulting in a total of 114 active projects. Plans for rehabilitation were formulated on 12 areas which are pending approval. The new project areas approved entail revegetation of about 82,000 acres of depleted Federal range. Within active projects 24,000 acres of range reseeding was accomplished, and 150,000 acres were treated for rodent control.

FIRE CONTROL

Approximately 100,000,000 acres of Federal range are considered to be within the urgent fire protection zone as determined cooperatively by Federal, State, and private protection agencies. Fire records are kept by calendar years. A total of 297,481 acres of Federal land was burned over in calendar year 1944 as compared to 1,206,715 acres in 1942. In this 3-year period the average size of fires has been reduced from 1,537 to 674 acres.

ACCESS ROADS

Participation in the construction of access roads to raw materials needed for war continued throughout the year but on a reduced scale. A total of 326 miles of roads was constructed, bringing the total mileage to 1,896 in 3 years. Principal materials tapped by these roads are copper, lead, zinc, iron, coal, timber, oil, fluorspar, talc, manganese, phosphate, corundum, vanadium, tungsten, chromium, mica, gilsonite, and arsenic.

TABLE I.—Number of licensed operators and livestock in grazing districts by regions, June 30, 1945

Region	Licensed operators	Cattle	Horses	Sheep	Goats	Total livestock
Arizona	621	109, 800	2, 414	105, 861	12, 684	230, 759
Colorado	2, 062	186, 216	7, 115	785, 961	164	979, 456
Idaho	3, 341	230, 690	16, 285	1, 072, 161	10	1, 319, 146
Montana	3, 201	264, 207	26, 350	1, 054, 055	44	1, 344, 656
Nevada-California	1, 539	406, 886	17, 557	809, 359	2, 815	1, 236, 617
New Mexico	2, 733	293, 524	9, 036	578, 814	35, 131	916, 505
New Mexico 7	1, 493	3, 151	5, 425	93, 466	11, 768	113, 810
Oregon	1, 459	216, 800	14, 716	278, 166	----------	509, 682
Utah	3, 739	195, 816	8, 155	1, 619, 898	3, 720	1, 827, 589
Wyoming	1, 462	169, 356	12, 181	1, 359, 171	250	1, 540, 958
Total	21, 650	2, 076, 446	119, 234	7, 756, 912	66, 586	10, 019, 178

TABLE II.—Status of grazing districts—approximate acreages of Federal land as of June 30, 1945

State	Number of districts	Withdrawn by establishment of grazing districts	Other land administered by Grazing Service	Total land administered by the Grazing Service	Other land	Gross area
Arizona	4	8,787,791	2,521,880	11,309,671	6,861,729	18,171,400
California	2	2,904,290	473,148	3,377,438	6,453,962	9,831,400
Colorado	8	7,547,765	596,161	8,143,926	7,759,774	15,903,700
Idaho	5	12,286,452	1,374,249	13,660,701	8,206,899	21,867,600
Montana	6	5,248,432	2,220,109	7,468,541	24,500,159	31,968,700
Nevada	5	32,513,531	1,100,648	33,614,179	13,164,921	46,779,100
New Mexico	7	14,224,335	2,056,045	16,280,380	23,467,020	39,747,400
Oregon	7	12,368,244	917,227	13,285,471	7,061,029	20,346,500
Utah	11	21,323,487	2,608,888	23,932,375	13,555,425	37,487,800
Wyoming	5	13,479,638	1,225,654	14,705,292	7,800,808	22,506,100
Total	60	[1] 130,683,965	[2] 15,094,009	145,777,974	[3] 118,831,726	264,609,700

[1] Includes vacant, unappropriated, and unreserved public lands covered by rights-of-way, unpatented mining claims; lands unreserved except for mineral withdrawals for classification and lands unreserved except for Public Land Order No. 35 but which have not been classified as valuable for vanadium.

[2] Includes certain Federal lands in withdrawals administered under agreement with other agencies and non-Federal lands administered under Pierce Act leases and cooperative agreements.

[3] Includes private, State, county, and certain withdrawn Federal lands which the Grazing Service does not administer.

TABLE III.—Cumulative summary of range improvement projects in grazing districts, 1935–45

Type of project	Unit	Completed fiscal year 1945	Total completed or acquired from April 1935 to June 30, 1945
Spring developments	Number	86	2,083
Reservoirs (stock water)	do	520	3,467
Wells (stock water)	do	45	824
Pipe and tile lines	Miles	7.25	63.25
Ditches	do	.8	58.5
Truck trails	do	342.1	10,516.6
Stock trails	do	83.8	1,680.4
Stock driveways	do	41	1,471.9
Bridges, livestock (over 20-foot span)	Number	----------	69
Bridges, vehicle (over 20-foot span)	do	7	112
Fences	Miles	390.3	7,136.6
Corrals and holding traps	Number	38	446
Cattle guards	do	50	736
Dipping vats	do	2	7
Telephone lines	Miles	4	380.7
Firebreaks	do	418	4,113
Boundary marking	do	322.5	4,729.5

Fish and Wildlife Service

IRA N. GABRIELSON, *Director*

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THE FUNCTION OF THE FISH AND WILDLIFE SERVICE

THE central function of the Fish and Wildlife Service is to effect and maintain an equilibrium of our native animal resources that will be most profitable to the most men. Ever since European man first landed on this continent, the forces of progress—i. e., growth of the population of man, the development of industry, the expansion of cities, the spread of highways, the facilitation of contacts with the rest of the world—have all constantly worked and will continue to work to destroy that profitable equilibrium.

VALUE OF ANIMAL RESOURCES

It is well worth the struggle and expense we must make to oppose such negative results of progress, especially since we can do this without opposing progress itself. Our national resources of birds, beasts and fishes, with the conservation of which the Fish and Wildlife Service is concerned, are valuable far beyond what can be expressed in dollars and cents. But if money be set arbitrarily as the whole criterion of worth, there are the following estimates on the fraction of United States fish and wildlife resources that can be evaluated from quantitative knowledge:

Resource:	*Capitalized value (billions of dollars)*
Water fowl	1. 5
Fur-bearing animals	. 4
Big-game animals	1. 3
Commercial fisheries	5. 8
Game fishes	5. 0
Total	14. 0

If now we take into account the unutilized resources, and such benefits as are rendered fields and forests by the insect control activities of birds, for example, and all the imponderable values, such as beauty and recreation, the amount derived above is perhaps no more than a tenth of the grand total, which may therefore conservatively be set at somewhere around 140 billion dollars.

EFFECT OF THE WAR ON ANIMAL RESOURCES AND ON CONSERVATION

Unlike the nonrenewable resources, our continental fish and wildlife have not, on the whole been adversely affected by the war. If anything, they have been benefited by it, since fishing (except for certain commercial species) and hunting have been below peace-time normals. Offshore wildlife, on the other hand, has suffered from the war. Many populations of birds and mammals which frequent the shore, the open sea, and the oceanic islands have been seriously decimated. Thousands of auks, murres, puffins, sea gulls, and ducks have perished from the effects of oil on the surface of the sea, which penetrates the feathers and ruins them as waterproof coverings.

The transformation of small islands in the Pacific from jungles to war camps has seriously diminished the abundance of sea birds requiring those islands for nesting sites, and has perhaps even extinguished at least two species, the Laysan Island rail and Laysan Island finch. The use of certain coastal islands for bombing practice has destroyed the nesting grounds of many birds frequenting our shore. Unknown quantities of whales, the most valuable animal in existence, have been killed in the course of submarine warfare. It will take at least 5 years of observation to determine the extent of these losses and to effectuate measures for recovery wherever the possibilities of recovery appear hopeful.

The most serious effect of the war on the conservation of our animal resources has been the loss of trained personnel by Federal and State agencies. This effect evidenced itself as soon as men began to be diverted to war occupations, several months before hostilities actually commenced. During the war years, so few young men were in a position to take the college training needed to turn out competent wildlife managers and conservationists that virtually none have been available for apprenticeship in the Fish and Wildlife Service. Consequently, there is now a wide gap between the beginning grades and those filled by such of the older, well-experienced men as have remained in conservation work during the war, and there are not enough of the latter to fill all the supervisory positions that will be required for vital postwar projects.

With an ever-increasing number of returned war veterans seeking to establish themselves in civilian life, there is the opportunity as well as the need for the Federal Government to encourage those suitably inclined to take the college training required for any of the several phases of conservation practice. This means that the Fish and Wildlife Service must cooperate with the universities in establishing and maintaining at a high standard of excellence, the kinds of courses which will produce the most effective men in this field.

During the war, the Federal Government has assisted in the training of visiting foreign students by granting generous traveling fellowships, paying living expenses and tuition in schools with curricula in fishery or wildlife biology. It is proposed here that similar fellowships be made available to United States citizens of promise. The choice of subjects for study and life work is exceedingly broad, as will be shown in the following account.

REFUGES

Among the activities of the Fish and Wildlife Service, none is more effective in wildlife conservation and restoration than a Nation-wide system of refuges. These are lands dedicated wholly to the propagation of wildlife by good management practices. From a modest beginning in the early part of the twentieth century, the system grew slowly for many years; and in the 1930's it was given great impetus by the allocation of special funds and by passage of the Migratory Bird Hunting Stamp Act. This act, which requires every duck and goose hunter over 16 years of age to buy a Federal migratory waterfowl hunting stamp, has provided annual funds ranging from half a million to nearly a million and a half dollars. Of this money, 90 per cent must be used for enlarging and maintaining the system; the remaining 10 per cent is available for the administration of the act.

In the past year, six areas, totaling in size over a million acres, were established as national wildlife refuges. These were located in Washington, Missouri, California, Florida, North Dakota, and Kentucky.

During the war years, the refuges have been operated on a strictly maintenance basis. With two thirds of all refuge personnel in the armed services, with construction at a standstill, and with maintenance reduced to the very minimum, water-control structures, patrol trails, buildings, etc., are deteriorating. An extensive program has been prepared for the rehabilitation of many of these developments, and for continuation and completion of the continental waterfowl refuge program.

It is estimated that about 25 percent of the ducks, geese, and swans in North America inhabit these Federal refuges. The value to the people of the United States in having these resources protected from the critical danger of extermination and in having them maintained in areas where conditions are most favorable to restoration, is estimated to be worth about 3 million dollars annually. The value of maintaining all of the other forms of wildlife in these areas—the nongame birds, the mammals, the fish—cannot be measured from any quantitative basis, may amount to as much as an additional 3 million dollars annually.

FEDERAL AID TO STATE CONSERVATION AGENCIES

Of equal benefit to wildlife conservation has been the Federal Aid to Wildlife Restoration Act of 1937, designed primarily to increase and improve conservation work by the States. Under the terms of this act, the Federal Government may pay a grant to any State which has enacted certain legislative measures to promote conservation. This grant contributes 75 percent of the cost of work performed on approved projects concerned with the purchase and development of lands, the restoration of natural environment, and the prosecution of research into problems of wildlife management. The source of this money is the revenue from the tax imposed on firearms, shells, and cartridges. The amount thus collected is set aside in a special account, known as the Federal Aid to Wildlife Restoration Fund. The amount unused in any year may be left in the fund for future use.

As a consequence of wartime shortages of personnel, equipment, and materials, this program has proceeded on a greatly reduced scale during the last 4 years. Last year, for example, the total Federal grant was only $900,000 —the lowest to date; and by June 30, 1945, nearly $11,000,000 had accumulated in the fund.

Judging from experience after the First World War, it is anticipated that the number of hunting licenses sold will increase by about 30 percent during the next few years, and Federal and State programs of wildlife management will have to be intensified accordingly. The International Association of Game, Fish, and Conservation Commissioners at its June 1945 meeting in Chicago passed a resolution favoring the appropriation of the aforesaid accumulated funds over a 5-year period, in addition to the regular annual deposits put into that fund.

EFFECT OF DDT ON WILDLIFE

World War II has brought into production and use a new insecticide known popularly as "DDT," dichloro-diphenyl-trichloroethane. This potent material has been used widely by the Army and Navy for control of pest- and disease-carrying insects in war theaters, chiefly in the Pacific. Unfortunately DDT has been found to be an unselective poison. It may kill, under certain conditions, a great variety of animal life, including birds, reptiles, and amphibians; and preliminary indication of this from laboratory tests has led to intensive studies to evaluate the damage that may result to wild animal life when forest, marsh, and agricultural areas are sprayed with DDT solutions. The

Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture has recognized the potential hazard in widespread use of DDT and has entered into a cooperative agreement with the Fish and Wildlife Service to aid in appraising the biological consequences of applying it. Various types of applications in various concentrations have been tried on experimental plots, some of which have been as large as 3,000 acres. Biologists of the Service are now intensively studying the effects of these experimental treatments on fish, birds, mamals, and other vertebrates. The objective of these studies is to find out what doses and formulae can be used with minimum damage to fish and wildlife.

PEST CONTROL

DEVELOPMENT OF A NEW RODENT POISON

Notable progress was made during the year in the search for new rodenticides through the development of a compound which already has become widely known under its laboratory serial number, "1080." This material, sodium fluoroacetate, is extremely toxic to rodents as well as to certain other mammals and birds. It is readily soluble in water, has only a slight taste in the dilutions in which it is commonly used, and lends itself well to most of the methods used in bait preparations for domestic rats and mice and for field rodents.

In the Southern States "1080" already has made an excellent record in the experimental control of Norway, black, Alexandrine, and frugivorus varieties of rats.

There still remain many aspects of the use of "1080" to be investigated. Its high toxicity portends possible dangers not only to persons who handle it but also to beneficial forms of wildlife that might be endangered in its field application. Studies are being pressed to the limit of available personnel and with the generous help of cooperators throughout the country, as well as of members of the armed services engaged in problems of rodent control abroad.

Correlated with the search for new rodenticides has been the continued effort to make the use of poisons as safe for beneficial or harmless wildlife as is humanly possible. Research is in progress in the use of color to make rodent bait unattractive to seed-eating birds without impairing its attractiveness to rodents. Results so far appear promising and already are being given practical application in field operations.

RED SQUILL

At the close of the fiscal year the national and international situation with respect to red squill, the source of the most important rodenticide for domestic use, was materially improved over that of a year ago. Thanks to numerous importations from the Mediterranean, the stock pile of squill in this country was increased to approximately a million pounds. Not only did the importations exceed in poundage those of any previous year, but the quality of the raw chips received was superior to that obtained in other recent years. Much of the material revealed a high enough toxicity to permit a reduction in the price of fortified squill. Determinations of the toxicity which led to these developments were made largely in the laboratory of the Fish and Wildlife Service. Samples imported from Italy were found to be comparable in toxicity to those from Algeria, whereas samples from Spain proved, as in former years, to be wholly nontoxic.

PREDATOR CONTROL

Meanwhile, the Fish and Wildlife Service has continued its program of organized hunting throughout the country for the reduction in the abundance of coyotes. This work is carried on primarily to reduce predation of livestock. During the past year, however, an epidemic of rabies among dogs, coyotes, and foxes has necessitated an intensification of this program.

The Service has also contributed greatly to the suppression of typhus, a disease endemic in the South, through its rat control work, carried on in cooperation with the States.

DEVELOPMENT OF THE RABBIT INDUSTRY

The shortage of meat during the war stimulated the development of a rabbit industry, which now gives evidence of continuing growth in the future. This new industry owes a considerable part of its success to the work of the Fish and Wildlife Service Rabbit Experimental Station at Fontana, Calif. There research is carried on to improve methods of managing, feeding, and breeding rabbits; and the results of these studies are made available to the public in a series of booklets. As a result of this research, domestic rabbits now outclass their ancestors of 10 or 15 years ago. They have better meat, finer fur, are more economical to feed, less subject to disease, and breed more true to color, size, and shape.

Small business characterizes the United States rabbit industry, most of the meat, fur, and wool being produced in small rabbitries whose owners devote only part of their time to the project. The amount of meat produced is impressive, being somewhere between 15 and 20 million pounds in 1944.

ALASKA FUR SEALS—AN EXAMPLE OF A WELL-MANAGED RESOURCE

One of the finest living examples of an animal resource that was once depleted by imprudent exploitation and restored by good management is the Pribilof Islands (Alaska) fur-seal resource, over which the Fish and Wildlife Service has jurisdiction, Virtually unaffected by the war, the fur-seal herd has continued to yield close to normal returns.

The fur-seal industry, estimated to be worth $100,000,000, has returned nearly $20,000,000 as net proceeds to the Treasury since 1867. From a low of about 130,000 seals in 1910, the herd has been restored through wise management practices to 3,000,000 animals, and is providing the Government with an annual net income of over a half-million dollars.

Rehabilitation of the 500 inhabitants of the Pribilof Islands, who were returned to the islands in May 1944, made possible the resumption of fur-sealing and related activities upon a normal basis. Sealing operations, however, were somewhat disappointing; the herd as a whole was late in arriving at the islands after their customary winter sojourn to the South. Furthermore, for some reason yet to be discovered, the 3-year-old males, the class from which nearly all killings are made, did not haul out in normal numbers, and the resulting take of 47,652 skins was less than anticipated. Other elements of the herd, however, appeared in usual numbers.

Of the sealskins taken, 20 percent, or 9,530, were delivered to a representative of the Canadian Government at Seattle, Washington, in accordance with the Provisional Agreement of 1942 between the United States and Canada, and the remainder were sent to the Fouke Fur Co. at St. Louis, Mo., for processing and sale.

During the year two public auction sales were held at St. Louis for the account of the Government. At the auction held October 9, 1944, 22,393 dressed and dyed skins, and 169 unfinished skins were sold for a total of $823,500.75.

On April 9, 1945, there were sold at public auction 22,682 dressed and dyed Pribilof Islands sealskins and 4 confiscated sealskins for a total of $811,992.75. In addition, there were sold at private sales for promotional purposes under special authorization, 214 dressed and dyed skins for $8,467.50. All of the sales were made at ceiling prices established by the Office of Price Administration.

THE MENACE OF POLLUTION

The distribution of all animals is controlled by the distribution of water. Even the most desiccated looking desert creatures, whose bodies are magnificently adapted to living in dry climates, cannot live permanently without it. Furthermore, each kind of animal depends for its living on a particular water habitat. Desert-living animals cannot live in marshes; marsh-dwellers cannot survive long in open lakes. Any change, however slight, in the water or the environment surrounding it affects the animal populations depending on it. But the progress of industrialization in the United States also depends on the distribution of water. For various reasons, industrial centers tend to become established close to large rivers, or bays on the seacoast; and from the beginning, they have defiled those rivers and bays with sewage and factory wastes. The effect on animal resources has been so wastefully destructive that pollution is now one of the most serious and complex of conservation problems occupying the attention of the Fish and Wildlife Service.

The Service has for the past 10 years carried on a series of experiments in various parts of the country to establish minimal standards of water purity necessary for the support of aquatic life. This information is required as a basis for effective control measures. It has been established that stream pollutants, regardless of their source, can be grouped into three classes: those which disturb the balance and general conditions of nature required to maintain aquatic life, those which have specific toxic action on fish or other aquatic forms, and those which combine both hazards.

The first group includes various effluents, both municipal and industrial, which reduce the dissolved oxygen, alter the acid-alkali balance of water, increase turbidity and reduce light penetration, blanket the bottom with unproductive materials, or otherwise modify general stream conditions. The second and third groups may be considered together because of the common hazard of toxicity to living things. In these groups are various metallic poisons, acids, dyes, organic compounds and sulfur derivates, noxious gases, such as chlorine and methane, and compounds like cyanids which enter the streams as by products or wastes from numerous types of industrial activities.

During recent years effluents of these types have been increasing in quantity and have been introduced into new areas as a result of the expansion and dispersion of industry of all types, particularly of war-munitions manufacture. To an already long list of industrial wastes known to be harmful to aquatic life have been added new kinds and additional quantities of harmful wastes from explosives plants, rayon mills, and synthetics manufacture. Not only has the quantity of waste materials increased from these processes, but, under the pressure of war, and with the shortage of materials for the construction of treatment and purification equipment, less attention has been given to either the recovery of useful and valuable byproducts, or to the treatment of harmful wastes for which no profitable market has been found.

It is extremely difficult to establish national standards of water purity necessary to safeguard aquatic resources. Experiments conducted by the Fish and Wildlife Service over many years have demonstrated that even the lethal limits of many specifically poisonous substances cannot be defined. This is because slight changes in the acidity or salt content of water, the dissolved oxygen, and the natural ability of water to neutralize acids, will materially alter the toxicity of many compounds. Copper sulfate, for example, was found to be toxic to most fish and aquatic animals in the water of one stream even when diluted with 4 million parts of pure water, while in another stream a concentration four times as great was readily tolerated by the same species because of differences in the amounts of other dissolved salts carried by the two streams.

Instead of being subject to uniform Nation-wide standards of water purity which government and industry could apply confidently, each stream or river basin presents individual problems which must be studied on the ground. Pollution abatement practices must be developed for each particular situation if our aquatic resources are to be protected.

Thus pollution is controllable only on local and State levels. At the same time, it is a national problem and it is the duty of the National Government to furnish guidance for the abatement of this nuisance. During the past year, the Fish and Wildlife Service has compiled the results of its long study on this subject in a bulletin entitled, "The Determination of Water Quality." This work, now in press, is designed to serve as a guide to those engaged in pollution control.

EFFECT OF WATER UTILIZATION PROJECTS ON ANIMAL RESOURCES

During recent years, a movement has been gathering momentum to develop all the inland waterways to their fullest extent, so as to utilize, by means of systems of dams, the flow and gradient of each river and its many tributaries to serve the purposes of navigation, irrigation, power and flood control. Although this development will undoubtedly proceed over a long period of time, a number of major constructions are planned to be under way in various parts of the country within the next five years.

The Fish and Wildlife Service is one of several Government agencies that are working together to achieve the maximum national benefits from these projects. Its particular function in this respect is to devise means of minimizing the inevitable damage which animal populations living around the affected water courses must suffer when their environment is changed. Like the pollution problem, no rules or principles exist or could ever be devised to solve the conservation problems of all water-use projects. When a single dam is considered by itself, it is usually possible to devise modifications that will help a migrating fish population like salmon to surmount it with no serious losses. When one dam is followed by a succession of others, blocking the upper reaches of a stream where the spawning grounds are located, the conservation problems become acute indeed.

An example of such a situation is the Columbia River, where a vast system of water-use projects is under development. One unit of this system is the Bonneville Dam, completed in 1938. Scientists of the United States Bureau of Fisheries (now part of the Fish and Wildlife Service) effected the safe passage of salmon over this dam by means of "fish ladders"; that is, a rising succession of pools, which the fish can easily traverse. A second unit of this system is the Grand Coulee Dam, which is too high for the salmon to surmount by any device. Here the fish were trapped and thence hauled overland by truck to tributaries below the dam. This bold experiment was attempted for the first time in 1944. The salmon were transplanted according to plan, they ascended the tributaries into which they had been introduced, and spawned successfully; and their young, guided by the memory of their infant experience, will return naturally to their adopted tributaries.

Getting the young salmon downstream with minimum mortality is another problem to be solved. Experiments designed to determine the extent of the mortality of downstream-migrating juvenile salmon in passing Bonneville Dam were continued by the marking of fingerlings and liberating them above and below the dam. Returns to date indicate considerable variation in mortality, ranging from 5 to 50 percent, and further studies are needed on the subject.

Meanwhile, special attention is being given to the various water-use projects proposed for the Columbia River Basin and their probable effect on the fishery resources. Ways and means of successfully caring for the fish at each structure or series of structures are being devised. A vastly expanded program of investigations has been formulated to obtain information necessary for the maintenance of the fishery resources under the proposed new conditions and preliminary studies are under way.

A similar plan of salvaging salmon at the Shasta Dam in California has been seriously hampered by the war. Because of a shortage of materials and manpower, fish trapping facilities could not be in readiness in 1943 when the spring salmon were blocked by Keswick Dam. Operations did not start until June 1 of that year and many of the salmon died below the dam. The effect of this delay in trapping and transferring the accumulated salmon will not be known until 1947, but it is certain that a portion of the spring run was lost. Such losses are extremely important, especially since the Sacramento River salmon fishery will have to be managed very intensively to achieve results comparable to those existing before the construction of Shasta Dam. It is estimated that the salmon maintenance program below Shasta Dam will be worth $2,000,000 per year to the fishing industry.

The second full year of operation of the Shasta salmon salvage program was considerably better than the first. Permanent equipment and facilities eliminated many of the difficulties of the previous year. The chinook salmon run into that portion of Sacramento River within the salvage area during 1944 was greater than had been anticipated.

ARTIFICIAL PROPAGATION OF FISH

From the Service hatcheries, fish and fish eggs totaling 5.7 billion valued at about $3,000,000, were released in the Nation's streams, lakes, and salt waters.

With the beginning of the war these activities were adjusted to place special emphasis on propagating the species of fish that contribute most to the food program. Among these were the salmons of the Pacific coast and the warm-water fishes which are used in stocking farm ponds. While the total output of fish and fish eggs from Federal hatcheries for the calendar year 1944 was slightly less than in 1943, there were increases in the production of commercially important chinook, silver, and sockeye salmons. The demands for spiny-rayed fishes, especially largemouth black bass and bluegill sunfish (the two species that have proved most useful in stocking farm ponds) surpassed production; for during the last half of the year the number of requests for fish with which to stock ponds was over 200 percent higher than in the comparable period of the previous year.

ALASKA FISHERIES

In Alaska the Fish and Wildlife Service exercises direct jurisdiction over the animal resources. In order to obtain the information needed for effective management of the fisheries, scientific studies of fish biology are in continuous progress. Under wartime conditions, lack of facilities and of trained personnel have resulted in these investigations being conducted on such a restricted scale that only a minimum of information has been obtainable in recent years.

CONSERVATION OF RED SALMON

Management of the red salmon fishery in Bristol Bay to insure a continuing high yield requires that enough fish escape the fishery to keep the population continually reseeded. To accomplish this, certain restrictions are imposed on the fishery, based on estimates of the probable size of run into each river system. During the past year, collections of catch records were maintained, and aerial surveys were again carried on over the entire Bristol Bay watershed to establish the magnitude of the run into each river system. This was done so as to determine whether or not the regulations limiting the catch were effective and also to provide a basis for estimating the probable return into each system when the progeny of this escapement have matured. As a part of this program a counting weir was again operated at Brooks Lake on the Naknek river system where an accurate count of the escapement into that portion of the watershed could be obtained.

At Karluk River, important in the production of red salmon, the catch is not permitted to exceed the escapement of spawners into the river. In order to effectuate this requirement, records of the catch in the area were maintained, and a counting weir was operated to obtain an accurate count of the fish entering the system to spawn. Surveys of the several tributaries to the Karluk Lake were made to evaluate the degree of utilization of spawning gravels.

In addition, the age composition of the stock was estimated by sampling the commercial catch. These data were used to calculate the ratios of return to escapement, information essential to determining what constitutes an adequate escapement and to predicting the magnitude of future runs.

CONSERVATION OF PINK SALMON

Studies of pink salmon in southeastern Alaska continued on a reduced basis. At the Little Port Walter Biological Station studies of the rate of infant survival were maintained, including annual counts of the spawning adults in the fall and of their progeny which migrate downstream in the spring. An unbroken series of these data are of primary importance to an understanding of the fluctuations in abundance which occur in this species.

CONSERVATION OF ALASKA HERRING

The value of the conservation policies employed in the Alaska herring fishery is demonstrated by a further increase in yield during the past year. A total of 107 million pounds were produced in 1944 as compared to 84 million in 1943 and 38 million in 1942.

Catch quotas, based on estimates of abundance in the coming season, were established for each of the three principal fishing districts.

Because the year broods produced in 1939, 1940, and 1941, which would support the fishery in 1944, were known to be above-average in abundance, an increase in quotas was recommended. Everywhere higher catches per fishing day and a higher total catch than in any of the past several years, corroborated these predictions. From mortality studies it is known that these same year broods, properly utilized in accordance with conservation principles, may be expected to survive in significant numbers through their ninth year of life. Under these terms there is promising evidence that this fishery may eventually be stabilized at an even higher abundance level.

CONSERVATION OF ALASKA SABLEFISH

An investigation of the sablefish of southeastern Alaska has revealed that a serious decline in abundance of this species has occurred. The return per unit of effort in 1944 was less than 40 percent of that which was obtained a decade ago. In spite of this low return, the incentive of high price has served to increase the fishing intensity, thus further reducing the abundance. As a step toward the rehabilitation of this resource, a closed period, intended to reduce the fishing intensity, was imposed in 1944.

MANAGEMENT OF OYSTER RESOURCES

From the viewpoint of conservation, oysters are peculiarly interesting because they can be cultivated like agricultural commodities, and their abundance and quality can be controlled with all the exactitude of properly run business enterprise. The development of oyster farming methods in the United States is an achievement of the Fish and Wildlife Service. The constant improvement of these methods is an important part of the Service program.

The war years have imposed severe hardships on the oyster industry. Shortage of manpower, difficulties of keeping boats in repair, military restrictions on oyster-producing areas, increased sewage pollution in regions where populations of war workers have flourished, have all tended to depress oyster production. For example, in the Hampton Roads area, the extent of pollution caused public health authorities to close planted grounds containing 2.6 million dollars' worth of market-sized oysters. This action led the Fish and Wildlife Service to conduct special bacteriological studies to determine the trend of pollution and the direction of its spread in the lower part of the bay. These studies have demonstrated that temperature and weather influence the bacteriological quality of water to an important degree; and they proved the necessity of partial purification, at the very least, of all sewage before it is dispersed in the bay.

Previous studies of the Service clearly demonstrated the need of managing public oyster grounds for their conservation and development. In cooperation with the Maryland Department of Tidewater Fisheries, the Fish and Wildlife Service conducted intensive ecological observations on the principal public reefs in the Maryland part of the bay. From field observations, the time of spawning and setting, the rate of growth, the size composition of the oyster population, and the quantity of oyster pests were determined. These data, summarized and analyzed, were made available to appropriate State officials with recommendations regarding opening and closing of grounds, time of planting shell, methods of controlling oyster pests, and other information pertinent to a well-operated program of State management. In accordance with these recommendations, grounds which had been closed to the fishery were reopened for a limited period. At a time when protein food was scarce, this action contributed an additional 640,000 pounds of oyster meat to the market. It also added $400,000 to the income of oyster growers. This was done without in any way damaging the potential productivity of the reefs.

CONSERVATION OF MARINE FISHERY RESOURCES

The great sea fisheries along the United States coasts have provided the Nation with an average of 4.2 billion pounds of food annually during the war. The biological study of these resources, to determine the facts needed to utilize them to their fullest capacity in accordance with conservation principles, is one of the major activities of the Fish and Wildlife Service.

THE HADDOCK

Among the most valuable marine fishes is the haddock, which yields an annual catch worth about 9 million dollars to American fishermen. This species has shown evidence of declining abundance on the principal New England fishing grounds which supply the bulk of the catch. Preliminary analysis of abundance indices, size, and age data show that the 1941, 1942, 1943 year classes on Georges Bank were relative failures. This caused some reduction in yield during 1944, which will become increasingly serious in 1945 and the first part of 1946. Various factors responsible for the failure of these year classes are being evaluated to determine the best way to make use of available stocks and, if possible, to prevent a recurrence of such a series of failures.

FLOUNDERS

The flounder stocks yielded a catch worth nearly 4 million dollars in spite of a serious decline in the production of the yellowtail flounder, which furnishes the major part of the flounder catch. Research efforts were concentrated on the collection of data covering the possible factors causing the decline. Analysis of the changes in the density, age, and size composition of the populations have been started, making use of age determinations from the scales and other techniques worked out during the past year.

ROSEFISH

Production of rosefish continued at a high level with a catch worth about 4½ million dollars, coming principally from Northern Gulf of Maine and Eastern Nova Scotian Banks. Study of fish scales and length composition showed that in both of these areas growth is very slow, the fish reaching a length of less than 9 inches in 10 years. After the first 1 or 2 years, growth is only 0.6 to 0.8 inch a year. Most of the fish do not mature until they are more than 9 inches in length. Accurate age readings for the older fish have not yet been established. In spite of the concentrated and intensive fishery there have been no striking changes in the average catch-per-day, but this appears to be the result of increased efficiency of fishing operations rather than to the maintenance of the fish populations at a constant level.

LOBSTER

The lobster catch, particularly that in Maine waters, has increased greatly since 1940; the 1944 landings in that State alone totaled about 14 million pounds and brought the fishermen about 4¾ million dollars. Analysis of the size composition of the lobster population has shown that, in part, this increased catch is the consequence of the increased size limit, in effect since 1942.

ATLANTIC SALMON

Studies on Atlantic salmon were limited to continuing the marking and stocking experiments begun in 1942. This program was designed to evaluate the various factors involved in restoring salmon, and to prepare for an expanded program in 1946. A total of 94,000 Atlantic salmon of various ages were planted during the year in the St. George and Penobscot Rivers; and 32,000 silver salmon from the Pacific coast were planted in the Pemaquid and Ducktrap Rivers.

CONDITION OF STOCKS OF FISH ON NEW ENGLAND BANKS

At the close of the fiscal year, most of the stocks of fish on the New England Banks, which during 1944 yielded the fishermen well over 40 million dollars, were in relatively good condition (compared to their prewar status), except for yellowtail flounders, Georges Bank haddock, and possibly a few others. However, the great increase in the fishing fleet during the past year will put an unprecedented drain on these stocks of fish.

PACIFIC PILCHARD

During the middle 1930's pilchard fishing along the Pacific coast was intensified through growth of the fleet of large purse seiners, increasing the exploitation 2½-fold and doubling the yield. For the 9 years of this high-fishing rate a fairly stable yield has been maintained by self-renewal. Biological work of the Fish and Wildlife Service has proved that this depended largely on sea conditions favorable to reproduction and survival of young for a number of seasons prior to 1940, and has suggested that during more recent years (1940–43) less favorable renewal conditions prevailed. Because the young from these years have not yet reached commercial maturity the full effect of these circumstances are not yet discernible. It remains to be seen whether this great biological resource yielding more than one half million tons of fish annually can hold up under the combination of moderate or poor reproductive conditions with the present high fishing rate. Unfortunately the research on this and related questions has been materially retarded during the last two years through cessation of sea work and diversion of personnel to war-emergency activities.

PROMOTION OF UTILIZATION

Conservation is concerned as much with the proper exploitation of animal resources as it is with their protection, since they have their maximum value to us only when they are fully utilized. It is one of the functions of the Fish and Wildlife Service, therefore, to promote the fullest utilization of the fishery resources. This it does by collecting and disseminating statistical and economic information, by carrying on research to improve techniques of catching and processing fish, and by working to enlarge markets for fishery products.

STATISTICS ON PRODUCTION

To serve the daily commercial needs of the fishing industries, the Fish and Wildlife Service collects current information on landings of fish at the various ports, on the volume of stocks held in cold storage, on shipments from producing areas, and on prices in central markets. Thus fishermen on Long Island, in North Carolina, or in Florida, for example, are given a basis for judging the demand in New York City, Boston, or Chicago. Likewise distributors in those cities are apprised of shipments of salmon and halibut from Seattle and Prince Rupert, or of shrimp from Biloxi, long before the shipments arrive. This service is designed to expedite trading and to obviate commercial gluts and famines.

During the war years this market news service was augmented by complete coverage of war orders issued by the Office of Price Administration, War Production Board, War Food Administration, Office of Defense Transportation, and other agencies whose activities affected the fisheries. Special issues of Fishery Market News, a periodical issued by the Fish and Wildlife Service, were devoted to listing O. P. A.'s maximum fish prices, and were used continuously by fish merchants throughout the war.

RESEARCH ON TIN SUBSTITUTES

Early in the war, the shortage of tin plate forced manufacturers of metal food containers to use substitute metals, chiefly various steel plates. These were treated chemically or with lacquers to prevent corrosion when packed with fresh or processed food products. An important project of the Fish and Wildlife Service, then, was to test these wartime containers by actual use. Results of these tests, which were performed on a wide variety of materials, were used as a basis for action in fish processing plants. Our technologists also tested fiber containers which were treated with such waterproofing materials as paraffin wax and beeswax. From these studies, recommendations were made to the fishing industry on types of materials found suitable for the transportation of fishery products.

RESEARCH ON METHODS OF SAMPLING FISH LIVERS

Early in the experimental work on vitamin-A rich shark livers, Fish and Wildlife Service technologists found that within the liver of each fish there is wide variation in the percentage of oil and in the vitamin-A potency. The earliest method of sampling for the determination of vitamin-A potency, which is the basis of the selling price, consisted of cutting sections from the liver. This method was inadequate, since a slight variation in the amount of oil contained in the livers would entail a considerable loss either to buyer or seller, depending on the direction of the variation. It was obviously necessary to devise a sampling method which would more accurately represent the total oil and vitamin content. This was a problem undertaken by the Fish and Wildlife Service at its Seattle laboratory. Extensive study and tests produced a device which takes a core sample down through the 5-gallon can containing the liver, and obtains quickly a sample representing the entire contents of the can with 95 percent accuracy. This device, now being patented under a public patent, is in wide demand by vitamin processors.

DEVELOPMENT OF QUICK-FROZEN PRECOOKED FISHERY FOODS

A newly developed product which promises to modify our living habits in the future is frozen, packaged cooked food. This has found wide use during the war for serving on board transport planes and in battle areas where it was not feasible to set up kitchens. Not all cooked dishes remain palatable when frozen. Some mixtures become undesirably tough and leathery; hence special recipes must be developed. In response to a request from the Army Quartermaster Corps Subsistence Research Laboratory, the Fish and Wildlife Service developed a large number of recipes utilizing fishery products which are suitable for freezing.

The results of some of these tests have been published and others are being prepared for publication. Meanwhile, several commercial fishery firms are marketing precooked, packaged, frozen fishery products.

MARKET DEVELOPMENT

At the end of August 1944, cold-storage warehouses throughout the country were stocked to capacity, fishery products alone amounting to a record total of about 123 million pounds. Army food authorities expressed concern over the situation and sought assistance in relieving the storage glut so that space for Army food stocks would be freed.

The Fish and Wildlife Service, in cooperation with the War Food Administration, immediately sponsored, planned, and executed eat-more-fish campaigns in several eastern cities. In these campaigns, which lasted 2 weeks to 1 month, posters, newspapers, radio broadcasts, car cards, and other media were utilized. Recipe books, leaflets, and bulletins containing marketing information about fishery products were distributed.

At the conclusion of the campaigns, fish dealers and retail food stores reported increases in sales amounting to 10 to 70 percent over previous similar periods.

VALUE OF THE FISH AND WILDLIFE SERVICE

In the foregoing pages, it has been shown by a series of illustrations that the Fish and Wildlife Service enlarges national wealth through a variety of activities. To summarize these in general terms, the Service:

Increases the stocks of fish and of wildlife;
Resists depletion of our animal resources;
Enlarges knowledge about them;
Improves and extends the use of them.

It is obviously as difficult and elusive a problem to evaluate these effects in dollars and cents as it is to evaluate the resources themselves. Yet an estimate has been made from such quantitative sources as are available. This estimate places on the total of these activities a value in the order of 30 million dollars a year.

Office of the Coordinator of Fisheries

IRA N. GABRIELSON, ***Deputy Coordinator***

* * *

AMERICA'S fishery resources have emerged from the strain of war as a vital element in the national life. During the period of hostilities they have been called upon to make large and essential contributions to the war program. This they have done. And not only have the Nation's aquatic resources provided, in larger quantity than was thought possible, the protein foods, vitamin oils, and numerous industrial materials needed for war, but they have been maintained in essentially sound condition and now stand ready to play new and increasingly important roles in the postwar period.

Likewise, the condition of the industry which makes these resources available to the Nation is good. In sharp contrast to the difficult days of 1942, when the fishing fleet had been crippled by the unavoidable requisitioning of 700 of its finest vessels for military operations, the industry now has the largest and most efficient fleet in its history. Some of the recent inventions and discoveries in the fields of science and engineering have already become part of the equipment of these boats; other developments, hitherto withheld from commercial use for security reasons, will soon become available and will give the fleet a vastly extended range and adaptability.

The part played by the Office of the Coordinator of Fisheries in bringing about the favorable condition of our aquatic resources and of the fishing industry now may be recorded in full.

The primary task which was assigned the Coordinator's Office upon its establishment in 1942 was that of restoring and maintaining the productive capacity of the fishing industry.[1] That capacity had been badly shattered by the events of the first months of war. Yet if fish, shellfish, seaweeds, and other aquatic products were to be produced in quantities at least approximately equivalent to the wartime need, the facilities of the industry had to be restored and maintained at a high level.

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[1] The Office of the Coordinator of Fisheries was established by Executive Order 9204, July 21, 1942. Under the original order it was authorized to coordinate fishery policies, plans, and programs; this broad directive was later considerably extended and clarified by Food Directive No. 2, issued by the Secretary of Agriculture on February 8, 1943, under which the Coordinator of Fisheries received specific authority over the production of fishery products.

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In all efforts to achieve adequate production, however, it was essential to guard against reckless squandering of our resources for a short period at the expense of the future. When the Coordinator's Office undertook its task, no one could foresee within even approximate limits how long the war would last. The fisheries are a renewable, but exhaustible, resource. The lessons of the last war were fresh in the minds of fishery administrators. At that time the valuable Alaska salmon fishery was overfished to provide a quick supply of food, and thereby suffered damage which has been repaired only after years of effort. The Coordinator's Office therefore adopted, and consistently maintained, the policy of protecting the fishery resources against excessive drains which would endanger their continued productivity, not only for whatever period the war might continue but in future years as well. In carrying out this policy, the Coordinator's Office opposed the removal or relaxation of conservation regulations for the sake of immediate, short-term benefit when it was believed that the permanent public interest would suffer thereby. The satisfactory condition of the fishery resources after 3½ years of war is evidence of the wisdom of this policy.

PROVIDING THE MACHINERY OF PRODUCTION

While protecting the basic soundness of the fishery resources, the Coordinator's Office assisted the industry to build up its machinery of production. The fishing fleet had been reduced to critically low levels immediately after the entrance of America into the war. By the summer of 1945 it had been restored to its full prewar size, and its efficiency had reached the highest point in the history of the industry.

The rebuilding of the fleet was accomplished by authorizing the construction by the industry of more than 2,000 new fishing craft and by demonstrating to the Army and Navy the need for the return of as many as possible of the vessels that had been requisitioned for military service early in the war. Working in close cooperation with the War Production Board, the Coordinator's Office arranged for adequate quotas of gasoline and Diesel engines to provide power for newly constructed vessels and replacements in old vessels. In addition, it assisted in providing engines and motors of various types, pumps, refrigeration equipment, and machinery for canneries and other shore plants.

In connection with the building program and with repairs and replacement of fishing equipment, the Coordinator's Office approved allotments of controlled materials, including steel, copper alloys, and aluminum, at the average rate of $10,000 worth of materials per day (for the period from May 1943 through June 1945) or a total of more than 9 million dollars' worth of materials.

Of the 2,002 vessels that had been authorized for construction by June 30, 1945, many were already fishing at that time and all but 85 were scheduled for completion by the end of 1945. In only a few classifications of vessels—notably tuna clippers and large New England otter trawlers—was the fleet still below the prewar level at the end of the fiscal year 1945. The tuna clippers were necessarily among the last to be replaced by new construction and by June 30, 1945, none had been returned by the military services. These vessels, which are among the largest and fastest of the fishing boats, require an especially large amount of materials and equipment.

About a fourth of the new vessels are shrimp trawlers, for use in the major fishing industry of the South Atlantic and Gulf Coasts. Because of the greater range and modern equipment of these new boats, the efficiency of the shrimp fleet has been greatly increased.

Many large otter trawlers, especially from the New England fleet, were requisitioned for war service. They proved so valuable for military purposes that some are still retained. However, the new medium trawlers and draggers replaced them so effectively that many records for production were broken early in the 1945 season.

Throughout the entire war period, the situation with respect to nets, hard-fiber twine, and cordage remained tight. Requirements of netting for camouflage purposes were heavy. By careful surveys of the needs of the various fisheries and scheduling of orders well in advance of the fishing season, it was possible to avert any major shortage of fish nets which would have interfered with production.

THE MANPOWER PROBLEM

The manpower shortage, both or fishing boats and in fish-processing plants, was acute throughout the war, becoming progressively more serious as more and more of the highly skilled fishermen were refused deferment. Through its membership on the Inter-Agency Committee the Coordinator's Office was able to demonstrate the irreplaceable status of some of these men, whose skills had been attained through long experience and whose knowledge was indispensible to the effective performance of the fishing boats. Deferment was obtained for some captains and mates, even in the younger age groups. While in general it was possible to recruit enough crew members to keep the available boats in operation, there were isolated instances where boats remained idle because there were no crews to man them. In the food-processing plants, the shortage of workers was so acute as to act as a brake on production at various times and places, especially in the sardine canneries of both the Atlantic and Pacific coasts.

PRODUCTION PROGRAMS FOR THE MAJOR FISHERIES

Throughout the greater part of the war period, the salmon and pilchard fisheries, which together produce about one-third of the total poundage of fish taken in the United States, operated under production programs administered by the Office of the Coordinator of Fisheries. The Alaska salmon fishery operated under such a program in 1943, 1944, and 1945. The much smaller salmon fishery in Puget Sound was placed under a similar program in 1944 and 1945. The pilchard production program under the direction of the Coordinator's Office was undertaken in 1943. These programs enjoyed the active cooperation and approval of the great majority of the fishing industry which each season requested the continuation, and in some instances the extension, of the programs.

ALASKA SALMON INDUSTRY

The production program applied to the Alaska salmon industry, the operating units of which are scattered over vast distances of the Territory, was in effect a consolidation which brought about a pooling of the available resources of manpower, boats, and canning equipment. This was done by concentrating the canning of salmon at certain key centers, and providing for the joint utilization by the various firms of the available facilities of production.

The consolidation was made necessary by the fact that the armed forces had taken over a large percentage of the tenders and power scows used by the industry in Alaska waters and also because not more than 50 or 60 percent of the normal supply of labor was expected to be available.

The concentration order for the 1943 season provided for the canning of the year's catch in 74 (later increased by amendment to 77) of the largest and most modern plants rather than the 120 plants previously used, and reduced the number of lines of canning machinery from 226 in 1942 to 131, with provision for maximum use of the high-speed machines.

The concentration program was designed to accomplish: (1) A reduction in manpower requirements by about 5,000 persons; (2) reduction of north-bound passenger accommodations by approximately 4,000 persons; (3) reduction in north-bound tonnage by 17,742 tons; (4) reduction in floating equipment by 86 tenders and 50 scows; (5) reduction in fishing apparatus by 48 traps, 25 purse seiners, and 67,130 fathoms of gill nets.

The program was considered so satisfactory that at the close of the 1943 season representatives of the salmon industry requested the Coordinator of Fisheries to take immediate steps toward a continuation of the plan in 1944. It was felt that the consolidation had saved the industry from becoming involved in ruinous competition for labor, transportation space, and equipment. As a result of its operation, the industry was able to increase its production of canned salmon, even though operating fewer plants, with less labor and less equipment than it would have used under normal conditions.

Because the situation, especially with respect to boats and equipment, had eased somewhat by the spring of 1944, the concentration program for that season was more liberal than that of 1943 in that it authorized the operation of 89 plants compared with 77 the previous year. Other important changes in the 1944 order were the assignment of manpower quotas to the various canneries, the quotas having been established previously by the War Manpower Commission. The 1944 order also provided that all persons, companies, and corporations authorized under the terms of the order to engage in salmon canning must obtain a license from the Fishery Coordinator.

The concentration program followed in 1945 was essentially similar to the 1944 order.

PUGET SOUND SALMON INDUSTRY

In order to save manpower and equipment, the Puget Sound salmon canning industry was placed under a concentration order at the beginning of the 1944 season. The concentration was effected at the request of the industry, in order that wartime operations in the Puget Sound salmon fisheries might be conducted as advantageously as those in Alaska.

The number of plants canning salmon in Puget Sound in 1944 was reduced from the usual 11, to 3—fewer plants than had operated in any year since 1893. Under the concentration plan, the largest plant in the area packed salmon for 9 firms. It was estimated that a saving of more than 525 cannery workers and tender operators was accomplished. In addition, there were considerable savings in the use of Diesel oil and the maintenance of cannery equipment.

The industry was continued under a similar concentration plan in 1945. However, four instead of three plants were authorized to operate, to provide for the somewhat heavier runs of salmon expected in the Puget Sound area that season.

PACIFIC PILCHARD INDUSTRY

The pilchard production program, which was directly concerned with a billion pounds of fish or nearly a quarter of the annual fishery production in the United States, differed considerably from the salmon concentration plan in its purposes and methods.

Unlike salmon, pilchards or Pacific sardines have several major uses, being processed into oil and meal in addition to being canned. Although each of these uses is important, the production of canned fish was considered most essential, the demand for this easily transported protein food for war purposes being greatly in excess of the supply. The production program for the pilchard fishery was therefore administered with a view, not only to increasing production, and conserving manpower and materials, but also to diverting the largest possible proportion of the catch to the canneries.

The first order issued by the Office of the Coordinator of Fisheries for the control of the production of pilchards became effective in the 1943–44 season. Under this order, all vessels engaged in pilchard fishing operated under permits issued by the Coordinator of Fisheries through his local representatives. The order applied to all vessels of 20 net tons or over, which had fished for pilchards at any time subsequent to May 31, 1940.

Although operating under the control of the Coordinator's Office because of the emergency, the industry remained under the general provisions of the State laws with respect to seasons and fishing areas. The Coordinator of Fisheries and his designated representatives were concerned largely with the distribution of fishing vessels among ports, with the delivery of the catch to canneries and reduction plants, and with determining how much of the yield should be canned and how much should be processed as meal and oil. Normally, about a quarter of the catch is canned as the familiar Pacific sardine and the balance is processed into meal and oil.

Generally speaking, there was gratifying cooperation on the part of the fishing fleets and shore plants in operating under the program. There was a stable and for the most part a well proportioned distribution of boats between ports and deliveries to the plants within the ports were in proportion to the quantities each plant could process. There were few instances where boats were delayed in unloading and these occurred only when huge catches were made on a number of successive days, clogging port receiving facilities.

During the second season in which a production program was followed, many of the difficulties met in its original operation were solved. As a result of this circumstance and of the generally more favorable conditions (additional boats, good weather early in the season, steady runs of fish) production during the 1944–45 season increased 15 percent over the previous year, and the pack of canned sardines increased 19 percent.

The quantity of canned sardines requisitioned by the Government was increased from year to year with the mounting needs for this protein food, in high demand because it is so easily transportable. During the 1943–44 season, the Government set-aside orders amounted to approximately half of the total pack. The following season the reservation for Government purchase was increased successively from 45 percent at the beginning of the season to 55 percent in the early months of fishing, and finally to 100 percent of the pack at the season's end. The Government requisition announced at the beginning of the 1945–46 season was 80 percent of the pack.

ALLOCATION OF HALIBUT

An order providing for the allocation among dealers of all halibut landed at United States ports on the Pacific coast became effective June 23, 1944. Under the terms of the order all persons or firms were prohibited from purchasing halibut without a permit issued by the Office of the Coordinator of Fisheries. The principal purposes of the order were to distribute halibut as efficiently as possible to meet war and essential civilian needs, to provide the various markets with essentially normal portions of the product, to support the price-control program of the O. P. A., and to facilitate the maximum production of halibut with minimum expenditure of critical materials and manpower.

In 1944 landings of halibut were allocated among dealers in each port on the basis of the total landings at that port handled by each dealer in a previous period, selected as a base. In 1945 the order was modified to provide for allocation to each dealer in accordance with his share, during the base years, of the halibut business of the entire coast, without regard to where the fish were landed. This amendment was intended to improve distribution, and to protect dealers from the effects of shifts of landings from port to port. The amended order also provided for the conditioning of permits to insure more normal distribution to inland markets.

PRODUCTION RECORDS DURING THE WAR PERIOD

The yield of fishery products suffered a drastic reduction during the first year of war. The normal peacetime yield of the fisheries is about 4.4 billion pounds. In 1942, however, the catch declined to 3.9 billion pounds under the stress of war-created difficulties of operation. By the end of 1943, the programs of the Coordinator's Office were beginning to exert their effect and the catch rose to 4.2 billion pounds. In 1944 it actually exceeded the peacetime average, a production of 4.5 billion pounds being achieved. During the first 6 months of 1945, still further gains were recorded in the fisheries as a whole.

Considered by classes of fishery products, the yield, in comparison with the need, was uneven. At no time was there enough canned fish to supply all civilian needs after essential war requirements had been met. Nor was there enough fish meal and oil for animal feeds, or oils for industrial purposes. The domestic vitamin oil industry developed by mighty strides, supplying the fish liver oils that formerly were obtained largely by import, but by 1945 it was apparent that additional domestic sources of oil would have to be discovered if the

United States industry was to prove capable of meeting the heavy demand for vitamin-A oils. Only in the fresh fish field was the supply commensurate with the need, and even fresh fish became scarce in 1945, owing to the extreme shortage of meat and consequent heavy demand for fish. It should be remembered, however, that the actual wartime needs for fish were far in excess of any previous production in the history of the industry; that the production achieved by the industry in the last 2 years of the war would have been considered excellent by any previous standards.

Probably no other nation in the world was able to maintain its wartime production of fish so well. It is a matter of record that most of the European fisheries were shattered, their fleets destroyed, their shore facilities wrecked, their accustomed fishing waters sown with mines. Most Asiatic fisheries were affected in similar fashion. The wartime difficulties suffered by the fisheries of the United States differed in character and in degree from those of most of the belligerents, but the impediments to operation, especially in the early years of war, were none the less real. The wartime achievements of the fishing industry are a record of distinguished service, and a testimony to what may be accomplished by cooperation in a common cause between Government and industry.

National Park Service

NEWTON B. DRURY, *Director*

* * *

THE increase of travel to the national park system areas after VE-day gave an intimation of postwar responsibilities that face the Service. This report, then, is not solely one of progress or accomplishment; it is also an analysis of the status quo in search of a workable plan to meet the immediate needs of millions of war-weary Americans, while serving their future needs by according the fullest degree of protection to the heritage embodied in the National Park System.

SERVICE HAS BEEN HOLDING THE LINE

This has all been recognized by Chairman Jed Johnson, of the Interior Department Subcommittee of the House of Representatives' Appropriations Committee. In discussing reductions in the 1946 estimates of funds for the national park system, he said: "America's entry into the war affected the National Park Service far more than any other agency within the entire Department * * *. The Service is to be commended for the spirit with which it has carried on under extremely adverse circumstances." The circumstances may be illustrated most effectively, perhaps, by the following tabulation comparing allotments provided and services rendered during the last prewar year (1941) with those of the war years:

	As of June 30—				
	1941	1942	1943	1944	1945
Employees	5, 145	4, 510	1, 974	1, 573	1, 577
Visitors	19, 306, 959	16, 034, 285	8, 228, 220	7, 460, 185	8, 546, 316
Appropriations	$9, 370, 030	$14, 609, 775	$5, 347, 365	$4, 563, 560	$4, 740, 810

Examples of the difficulties of wartime operation are many. A few might here be given. In Glacier National Park, where the forest fire danger is high, there are 1,085 miles of fire-fighting and tourist trails which have to be opened not once, but several times yearly. Only by means of camps of conscientious objectors assigned by the War

Department was it possible to maintain these trails in usable condition. In Hawaii National Park, with extremely heavy visitation of armed forces personnel, the greatly reduced staff was inadequate even to maintain trails and comfort stations or provide police and fire protection.

In September, the most severe hurricane in 40 years whipped the Atlantic coast, seriously damaging several Service areas. At Fort Raleigh National Historic Site, as an example, between 70 and 80 trees were blown down and the palisade fence surrounding 16 acres was flattened. Only through $1,195 of emergency reconstruction and fighting forest fires funds was it possible to accomplish such repairs as could be made. At Petrified Forest National Monument, lack of maintenance men made it necessary to utilize protective personnel, badly needed to prevent vandalism and theft of petrified wood, in emergency maintenance of the power plant, water system, and other facilities. These situations are typical of the entire national park system, but the ingenuity and cooperation of our employees enabled us to keep the numerous units of the System in operation and open to visitors, many of them in the service of the United Nations.

Passage of the peak in the program of organizing the Nation's resources for war and the progress of the war toward its victorious end resulted in a sharp decline in applications for military and other wartime uses of Service-administered areas during the past year. Only 455 new special use permits were granted, 228 previously issued permits were continued, and 602 were terminated. In all, 2,396 war use permits have been issued for national park areas.

Although the work of the National Park Service was not considered to be tied in directly with the prosecution of the war, the areas it administers provided much-sought recreational opportunities for members of the armed forces and those engaged in war industry, and it is also fair to say that the system through war permits made its appropriate contribution to the victory. The use of park lands for military purposes made unnecessary the purchase of other lands, so that there was an estimated saving of approximately $30,000,000 of the funds of the Army, the Navy, and other war agencies that otherwise would have been expended for land. Yet there was little destruction of park properties through these emergency uses. Under mining permits, as a matter of critical war necessity, tungsten was obtained from an isolated section of Yosemite National Park, in accordance with the previously announced attitude toward such proposals. The national parks, it is believed, are not the places in which to experiment with new developments in transportation. Aside from the fact that safe locations for landing strips are few in the rugged western parks, it is doubtful if such facilities within the parks would provide material advantages over those which might be established at short distances beyond their borders. Railheads are generally outside the parks. The same should be true of airports.

Two pending legislative proposals, in addition to those directed at Jackson Hole National Monument and the Antiquities Act, would or could affect certain Service-administered areas adversely. The bills providing for the establishment of a Missouri Valley Authority (S. 555 and H. R. 2203) contain no provision exempting Yellowstone, Glacier and other units of the national park system situated in the Missouri Basin from the construction of water-control structures within them or that would impound waters inside their boundaries. A threat to the historical atmosphere and the Colonial character of Colonial National Historical Park is found in the Bland bill (H. R. 26) which would authorize the construction of a lofty suspension bridge across the York River at Yorktown, of which the elevated southern approach would be constructed on park lands. The Secretary of the Interior and the Service have endeavored to meet this threat by pointing out the advantages of other locations for the proposed bridge.

Those who appreciate the charm of the old Chesapeake & Ohio Canal, now a part of the National Capital Park system, and the scenic values of the Potomac Valley, including the Great Falls, a short distance above Washington, were heartened by the strong protests registered against the Corps of Engineers' proposal to construct a series of flood-control power dams along the course of the Potomac, and the consequent decision against this proposal.

TRAVEL TO NATIONAL PARK AREAS INCREASING

The fact that, despite tightened rationing of gasoline and a Nationwide campaign to reduce civilian use of common carriers to make room for war transport, the number of visitors to units of the national park system increased from 7,460,185 during the year ending June 30, 1944, to 8,546,316 for the year ending June 30, 1945, indicates the pressure for services and accommodations under which the greatly reduced staffs of the National Park Service and of the concessionaires had to operate. Many of the visitors were war industry workers and their families moving to other jobs, and uniformed personnel of the armed forces traveling between stations or coming in groups to the parks and monuments for rest, recreation, or recuperation.

Throughout the year, the policy of refraining from all activities which would tend to promote travel was continued. No effort will be devoted to that end in the near future. It need not be. After the war many areas in the System will have many more visitors than can be accommodated satisfactorily with existing facilities. Effort needs to be directed rather toward effecting a more even distribution of travel, so that peaks may be at least partly leveled off, and more visitors may derive greater enjoyment from their visits than can be obtained during the crowded periods.

A statistical tabulation of areas and the volume of travel to each appears on pages 228 to 231 inclusive.

CONCESSIONAIRES FACE WARTIME DIFFICULTIES

Concessionaires continued to operate on a limited scale throughout the year. In areas near war activity centers they encountered great difficulty in meeting demands because of manpower and food supply shortages. As required by their contracts, concessionaires furnished limited services such as stores, meal and sleeping accommodations, and other requirements, in areas where distinct need was manifest. All OPA rules and regulations with respect to ceilings and food and gasoline rationing were applied in national parks as elsewhere. The Service worked with the concessionaires in meeting problems caused by drastic fluctuations in the volume of service. In two specific cases, with approval of the Comptroller General, concessionaires were authorized to terminate or temporarily suspend services called for by their contracts.

The Western Conference of National Park Concessionaires met in Los Angeles on April 24–25, with the Director and a few officials of the Service in attendance, for discussion of such subjects as employee wages and hours, sale of souvenirs, public health, postwar travel trends, and postwar planning of accommodations.

National Park Concessions, Inc., a nonprofit distributing corporation, continued to furnish facilities at Mammoth Cave, Isle Royale, and Olympic National Parks. It did not operate on the Blue Ridge Parkway nor in Vanderbilt Mansion National Historic Site because of war conditions, but will start operations at these places and in Big Bend National Park whenever postwar relaxations permit the construction of needed accommodations.

LIMITED ADVANCE PLANNING ACCOMPLISHED

The "closed for-the-duration" status of development and construction continued, and planning activities have dealt primarily with preparation for transition from wartime restrictions to normal postwar activities. This standstill in development provided an opportunity to appraise past efforts and to make definite plans for the future. Studies were undertaken to establish a basis for future policies regarding all-year use at areas such as Crater Lake, Mount Rainier, and others where developments cannot be planned until a definite use policy is established.

Special Problems

Consideration was given to the type, extent, and location, or relocation, of concession operations at Sequoia-Kings Canyon, Yosemite, Big Bend, Isle Royale, and Olympic National Parks. The location and extent of headquarters developments at Great Smoky Mountains, Antietam, Petersburg, and Gettysburg were also studied.

Advance Planning

Although master plan work was in general limited to minor revisions, preliminary plans were made ready for Big Bend, Grand Teton, and the Jamestown Island section of Colonial National Historical Park. A new master plan was prepared for Carlsbad Caverns National Park and the first complete plan for Natchez Trace Parkway was submitted. Although lack of funds prevented planning of specific postwar development projects, a number of steps were taken in preparation for this program. Two postwar project programs were tabulated, with expense and time estimates, as part of the over-all Department of the Interior program. In an effort to establish a priority on future work for survey or construction, priority lists of important road, trail, physical improvement and parkway projects were prepared.

Late in the year, a landscape architect was established at Juneau, Alaska, to begin the basic field study and planning which must precede any developments on the five units of the National Park system in Alaska. Architects assigned to the Blue Ridge and Natchez Trace Parkway offices collaborated with the Public Roads Administration in the production of contract plans for bridges and grade separation structures.

PROTECTION CONTINUED UNDER HANDICAPS

Fire Prevention and Suppression

As the virgin forests of the Nation are cut or otherwise modified by commercial uses, the remnants preserved within the National Park system increase in importance to the Nation. Fire is always the great threat to those forests. Despite shortages of manpower and equipment, it is reported with considerable satisfaction that only 276 forest fires occurred in areas of the National Park system during the calendar year 1944, the smallest number during any year of the past decade. A total of 4,928 acres was burned over, of which 973 acres were forest, 607 acres brush, and 3,349 acres grassland. Intensive fire control training activities were continued by means of regional conferences. Deterioration of specialized and mechanized control equipment, impossible to replace during the war, and the necessity of using inexperienced youths and older men in fire control added to the normal problems of this protective work.

Combating Forest Insect Pests

Because of wartime relaxation of insect control measures, widespread epidemics developed in certain sections of the West and directly affected some of the park areas. It has been possible to handle incipient epidemics in some areas, but serious losses are faced in other sections because of inadequate funds to attempt complete control. Among forest insects combated were the spruce budworm in Rocky Mountain, bark beetles at Scotts Bluff and Bryce Canyon, Engelmann spruce beetle at Cedar Breaks, and saw flies, "loopers," leaf miners, and tent caterpillars at Zion.

Combating Tree Diseases

White pine blister rust continued to spread southward both in the East and in the West. Control work consisting of destruction of the alternate host (currant and gooseberry bushes) during calendar year 1944 included eradication on 1,603 acres and re-eradication on 8,533 acres, the maximum possible under manpower shortages. It is imperative that initial control be intensified, particularly in California, if the magnificent sugar pines of Yosemite and Sequoia-Kings Canyon are to be protected before the disease reaches those areas. The beech bark disease has invaded Acadia National Park but is being fought successfully by sprays which control scale insects whose attack precedes infection. Continuing control is essential.

Studies on the cactus necrosis, which became epidemic in Saguaro National Monument, indicate that the disease is fatal to old, mature plants, that its progress can be slowed by treatment, but that the principal threat to the continuation of the cactus forest is the lack of reproduction, due to overgrazing.

Soil and Moisture Conservation

Accelerated erosion on arid lands, often aggravated by overgrazing, has been controlled to some extent by measures financed through Departmental Soil and Moisture funds. Major prehistoric ruins in Canyon de Chelly and Chaco Canyon National Monuments have been saved from destruction by diverting or dispersing flood waters which have cut channels threatening to undermine these ancient pueblos. Nine units of the system benefited by soil and moisture work, including the new Big Bend National Park.

Impact of Visitor Use

Human use, which beyond a certain point inevitably results in wear and tear, during the war relaxed to some extent with the marked reduction in travel. Studies were made at Zion National Park in an effort to determine harmful effects of past use and provide future controls. Carelessness and vandalism continued, especially at the Petrified Forest and in the various limestone caverns, where the temptation to take souvenirs seems well nigh irresistable to some. At Carlsbad Caverns National Park, an experiment in prevention of vandalism through education was tried with some success on the theory that when people understand the vast length of time and the intricate processes required by nature to create irreplaceable formations they will think twice before wilfully destroying them.

Protection of Prehistoric Ruins

Throughout the Southwest prehistoric Indian ruins are subject to the destructive effects of weather and, to some extent, rodents and livestock. During wartime, almost no funds were appropriated for protective work, and accelerated deterioration resulted. Unless a determined and well-financed effort is made to preserve what remains, the life of many of these structures is definitely limited.

Grazing Eliminated in Big Bend

Although transportation and manpower difficulties impeded the removal of stock from lands within Big Bend National Park and in a few cases extensions were provided, over 90 percent of all stock had been removed at the year's end. In some portions of the area, improvement in vegetation is already noticeable.

WILDLIFE MANAGEMENT

The majority of wildlife problems in national parks and monuments arise from factors over which the National Park Service has little or no control, either because areas are too small or because their boundaries are such that they provide incomplete biotic units. They are therefore affected materially by such outside influences as predator eradication, competition with domestic livestock for food during winter periods when game and other animals migrate beyond the boundaries, and hunting; these, in turn, result in the building up of surpluses of certain species, and overconcentrations in certain locations. The end result is adverse effect upon both wildlife and vegetation, including the forests.

Such situations make it difficult to develop management programs that will assure reasonably stable wildlife populations. They require constant study and the development of management practices based upon it. Overpopulations of game animals in several parks have stimulated group pressure to open them to public hunting as a means of harvesting the surplus. Aside from the fact that it is prohibited by law, the National Park Service is convinced that any authorization of hunting would establish a dangerous precedent, as well as have other detrimental effects. Where control has been necessary, the Service has continued to exercise it. Reductions were carried out at Rocky Mountain National Park, where 301 elk and 113 deer were removed, and at Zion National Park where 112 deer were killed. Normal hunting outside of the boundaries of Yellowstone National Park kept the elk herd there at a safe level, so that no reduction was necessary.

The past year saw progress in the Service's program of eliminating feeding and other artificial controls over the bison of Yellowstone and reestablishing these animals in their native state—a program based on the long-established policy of displaying the wildlife of national parks under conditions as nearly natural as possible. Careful attention will continue to be given to the herd so that any detrimental developments or influences may be recognized and steps taken promptly to correct them.

The ban on the feeding of garbage to the bears of Yellowstone and Yosemite has been maintained, and though there has been some criticism of it by those who consider "bear shows" in national parks an attraction to many visitors, the Service feels that it is entitled to ample time to test the practicability of the revised practices as an improvement for both the visitors and the bears. No doubt the "shows" have been an attraction to many. However, they have produced wholly unnatural concentrations of both black bears and grizzlies, have tended to make them dependent on man and unwilling to shift for themselves, and have displayed these animals under artificial conditions. The principal problem still faced by the Service in connection with these animals is the insistence of some visitors on giving them "handouts," a dangerous practice the prohibition of which is difficult to enforce.

Because of the continuing problem of bighorn sheep-wolf relationships at Mount McKinley, arrangements have been made with the Fish and Wildlife Service for a study to determine what action, if any, is required. Observations at Joshua Tree National Monument indicate that both deer and desert bighorn sheep increased there during the year. The reestablishment of wild turkeys at Mesa Verde National Park appears to have been successful. The use of park waters by fishermen brought up numerous questions of fish management, but the establishment of effective controls are dependent on securing factual data. The Fish and Wildlife Service completed studies in Big Bend National Park as a basis for setting up fishing rules and regulations there. In Glacier National Park, a Fish and Wildlife Service aquatic biologist carried on extensive stream survey work leading to obtaining evidence as to migration and reproduction habits. The study is designed also to provide an evaluation and comparison of various stocking practices. Fish management studies were also initiated in a few parks by National Park Service personnel.

COOPERATIVE RESPONSIBILITIES GROW

Completion of the Alaska Highway Study, undertaken with funds supplied by the Army, was followed by a request from the Corps of Engineers, under section 4 of the 1944 Flood Control Act, for an appraisal of the recreational resources of 68 reservoir sites under consideration by the War Department, and these studies are being undertaken. Cooperation with the Bureau of Reclamation in studies of reservoir basins which they plan to develop or have developed continued in increased volume. This involves a series relating to Missouri Valley reservoir projects likely to extend over several years. The Service also conducted investigations of the recreational potentialities of 100 sites under consideration on seven river basins in Texas, Oklahoma, and portions of Kansas, Colorado, and New Mexico. Planning studies continued, in cooperation with the Bureau, on the Columbia Basin project, while the survey of the recreational resources of the Colorado River Basin, under way for several years, made material progress.

Administration of the recreational activities at Shasta Dam and Friant Dam in California, in addition to planning and development, comparable to that which the Service has furnished for some years at Boulder Dam, was provided for in an agreëment with the Bureau of Reclamation, and a start was made on the establishment of the needed planning and administrative organization. A similar responsibility has been placed on the Service with reference to Lake Texoma, in Texas and Oklahoma. Though the acquisition of additional lands to insure proper development was recommended, no steps have been taken in this direction.

HISTORIC SITES ACT TEN YEARS OLD

During the 10 years since President Roosevelt approved the Historic Sites Act, 560 historic sites have been inventoried and 334 archeological sites have been cataloged. Sixteen of the sites recommended by the Advisory Board on National Parks, Historic Sites, Buildings and Monuments have been approved by the Secretary and created national historic sites. Each of these fills an important place in the Federal program of presenting a well-balanced pageant of American history. The studies have accumulated a large body of basic data useful to the Secretary and to Congress in considering establishment of new areas and in formulating policies for preservation and restoration. They emphasize the richness of the Nation's historical and archeological resources. It is hoped that the historic sites survey, now a little more than half finished, can be completed in the early postwar period.

The first meeting of the entire Advisory Board on National Parks, Historic Sites, Buildings and Monuments since May 1942, was held in Chicago on December 7–9, 1944. On March 8–9, 1945, a meeting of the interim committee of the Board was held in Washington, D. C. Tom Wallace of the Louisville Times was appointed to fill the vacancy on the Board created by the death of Richard Lieber. On June 14, 1945, the Board suffered the loss by death of its chairman, Edmund H. Abrahams, who had served on the Board since its inception and whose wide knowledge of national park problems had been a great aid to the Service. To aid in the investigation, selection, treatment, and interpretation of historical and archeological areas, the American Council of Learned Societies defrayed the expenses of a conference in Morristown, N. J., June 7–8, 1945.

Successful prosecution of the war was reflected by increased public interest in certain types of historical reservations, particularly memorials, associated in the public mind with the ideals of liberty and democracy for which this Nation stands. The Statue of Liberty National Monument, which participated with its lights in the VE-day observance, was the scene of a great Fifth War Loan drive rally on June 2, 1945. An illustration of the colossal stone portraits of former presidents constituting the Mount Rushmore National Memorial was widely distributed as a Seventh War Loan drive poster.

The huge cyclorama, a painting 400 feet long by 50 feet high, portraying Pickett's charge in the Battle of Gettysburg and located in Gettysburg, Pa., was designated a national historic object by the Secretary on October 5, 1944. Painted by Paul Philippoteaux in 1882 at a cost of $100,000, it is considered an accurate portrayal of Pickett's action. Among other important historical acquisitions during the year was the Historic Boundary Oak, perhaps the only living object on Abraham Lincoln National Historical Park dating back to the time of Lincoln's birth.

VARIETY OF LAND PROBLEMS FACE SERVICE

Non-Federal Lands in Service Areas

During 1945, as in the past, many problems of development planning, protection, and administration defied solution because of lack of land control. Within the boundaries of units of the National Park System there are more than 600,000 acres of non-Federal land. During the year considerable progress was made in obtaining detailed information as to the location, importance, and physical characteristics of these lands. One of the greatest needs of the National Park System is an orderly program of land acquisition, based on reasonable recurring appropriations, and directed toward the ultimate elimination of non-Federal land ownership within authorized boundaries of all park areas. Until such a program can be established, scenic values will continue to be lost, undesirable developments and uses will persist, and difficulties in planning and providing for needed developments will continue to plague the Service.

The serious situation existing in Joshua Tree National Monument, where thousands of acres of railroad lands checkerboard a large part of the area, well illustrates this problem. The possibility of a promotional land-selling project threatens the future of this monument.

In Glacier National Park, the Izaak Walton League of America, Inc., made an emergency purchase of 10 lots near Lake McDonald to be held until such time as the Service is able to buy them from the league. The league set up a land purchase revolving fund to be used in similar emergencies to buy non-Federal lands.

As a basis for rounding out ownership or eliminating lands whose retention is not justified, the Service has made a small beginning on the review of boundaries of each area under its administration. Studies were made of boundary problems at Zion National Park and Monument, Grand Canyon National Park and Monument, and Wupatki National Monument. Similar studies were made for the Bureau of Reclamation at Boulder Dam National Recreational Area.

New Areas and Additions to Existing Areas

Actual land changes in the National Park system were few. Investigations of proposed new areas ceased during the war, and acquisitions were confined to acceptance of donations under authority of Congress or to minor boundary rectifications. At the close of the fiscal year, the system contained 168 units, one new unit having been established and two eliminated since June 30, 1944.

After some 8 years of endeavor, the Richmond National Battlefield Park, Va., notable as the scene of several bitter battles during the Union drives on the Confederate Capitol, was established on July 14, 1944, when the Department accepted title to 688.44 acres from the Virginia Conservation Commission. Added to Shiloh National Military Park, Tenn., was a small but important tract of 0.93 acre donated by Mr. and Mrs. W. A. Shaw, and accepted by the Secretary on March 12, 1945. All titles having been cleared, the 80-acre Adams estate was added to Lava Beds National Monument, Calif., through acceptance of deeds by the Secretary in November 1944. On July 28, 1944, the Secretary accepted approximately 32 acres of land in Hot Springs National Park, on which the United States Public Health Service operates a Medical Center. Thurston Lava Tube lands totaling 20.6 acres in Hawaii National Park were accepted by the

Department on April 11, 1945. At Mount Rainier National Park, a contract to purchase 304.84 acres of Northern Pacific Railway timberlands, adjacent to the Nisqually entrance road, which the Service has been attempting to obtain for 19 years, was approved.

Reductions

Custody of the Chattanooga National Cemetery, Tenn., was transferred back to the War Department on March 1, 1945. Camp Blount Tablets National Memorial, Tenn., although listed under the 1933 Presidential Reorganization Order, was found to have no legal status as Federal property.

Projects and Prospects

Because of oil exploration activity on the North Carolina "Banks," North Carolina State authorities have had to delay the acquisition of lands essential to the Cape Hatteras National Seashore Recreational Area project, authorized by act of Congress August 17, 1937. Progress on the 10,000-acre Cumberland Gap National Historical Park project, with lands in Kentucky, Tennessee, and Virginia, has been encouraging. Four thousand acres of the 5,100 in Kentucky have been acquired by the State, and Tennessee has completed surveys on approximately 2,600 acres for proposed acquisition.

By congressional act approved December 6, 1944, provision was made for acceptance by the Federal Government of lands and waters within the Everglades National Park project, Florida, for wildlife protection only, pending establishment of the authorized national park. Title papers relating to the first conveyance by the State of Florida of more than one million acres of the project are in the hands of the Fish and Wildlife Service, which will protect the extraordinary bird life and other biological features of the area.

The Fort Frederica National Monument Association, Georgia, had acquired nearly all of the land involved in this project by the end of June. The entire area has since been accepted and the monument established.

The Grandfather Mountain Association, a non-Federal body in North Carolina established for the purpose of acquiring lands for this proposed addition to the Blue Ridge Parkway, has obtained price quotations and tentative agreements from the landowners. Congress having authorized the establishment of a national monument of not more than 1,500 acres at Harpers Ferry, W. Va., the prospective area was carefully studied and recommendations as to the lands to be included were presented to the Secretary.

The State of Iowa has acquired approximately 1,000 acres necessary for the Iowa Indian Effigy National Monument project. Conveyance of the land to the Federal Government and establishment of the national monument is anticipated in the near future. Efforts continued to complete the land and development programs of the Manuelito National Monument project in Arizona and New Mexico. The Queets Corridor and Ocean Strip, Olympic National Park, a Public Works project embracing the scenic and picturesque coastal area of northwestern Washington, remained in the acquisition stage.

By his first action in direct connection with a project of the National Park System, President Truman approved the Touro Synagogue National Historic Site project, Rhode Island, on April 19, 1945.

To be administered by the Service as a national historic site, the Adams Mansion project, Quincy, Mass., was near fulfillment at the year's end. This house, the home of generations of this famous family, possesses exceptional historic value.

Legislation authorizing the establishment of Patrick Henry National Monument at Red Hill in Virginia was repealed by act of December 21, 1944. The State of Virginia has undertaken a similar project.

Water Rights in the Western States

The Service has completed 10 years of concentrated effort to establish rights to use water in its various areas, started in February 1935 with Civilian Conservation Corps funds, and is now in an excellent position to keep the work abreast of new construction and water use when the public resumes peacetime recreational travel.

Recreational Demonstration Area Transfers

Fall Creek Falls and Shelby Forest recreational demonstration areas, totaling 28,035 acres, were transferred to Tennessee for State park purposes, in accordance with the terms of the act of June 6, 1942, and 1,072 acres of the Otter Creek area in Kentucky went to the War Department as an addition to Fort Knox. The transfer of the 66,376-acre Roosevelt area in North Dakota to the Fish and Wildlife Service for establishment as an upland game refuge has been approved by the President but had not been completed at the year's end. Fourteen additional areas, totaling 81,251 acres, in California, Georgia, Kentucky, Missouri, Oregon, Pennsylvania, and Virginia are available for transfer to the States.

EMPLOYMENT CRISIS ENDED

Some handicaps continued in the basic fields of administration, protection, and maintenance as a result of the wartime curtailment of staff and the necessity of leaving positions vacant or filling them with inexperienced personnel. That the major duties of the Service were discharged creditably is a tribute to the loyalty, determination, and hard work of employees, new and old.

The rate of losses to the armed services diminished during the year, mainly because few physically fit men of military age remained. However, in accordance with the announced policy of the Selective Service System not to induct men beyond an age desirable for military service who are engaged in essential occupations, a few deferments were requested and approved.

While vacancies during the year averaged approximately 10 percent of permanent positions, the crisis in employment has passed. By June 30, 1945, 33 veterans had returned to their former positions in the organization. This number is small compared to the total number of employees on military furlough, but it is indicative of the trend. More and more veterans are becoming available for original appointment.

Many men now in the armed forces have expressed interest in the National Park Service as a postwar career. Some of this interest has been aroused as the result of visits to units of the system as part of a military training program, en route between assignments, or attendance at a rest camp. Names of these inquirers have been recorded so that they may receive announcements of suitable examinations, and they have all been encouraged to renew their applications immediately upon discharge.

Service requirements offer a great variety of opportunities for the employment of special talents and interests in the field of conservation. The maintenance of high standards of performance rests upon placing each employee in the position for which his interests and ability best qualify him. To determine and record these interests and qualifications and at the same time to train new employees in the details and requirements of the positions which they will fill on entering the Service necessitates the establishment of a program of in-service training. For many years the Branch of Forestry has maintained such a project in training new and old employees in the latest fire-fighting practices and use of equipment. Several colleges and universities have expressed interest in establishing courses leading toward preparation of students for careers in national park administration, an interest which the Service has encouraged through suggestions for use in setting up a curriculum.

Important Personnel Actions

Charles L. Gable, Supervisor of Concessions, retired because of disability, and Oliver G. Taylor, formerly Chief of Engineering, was placed in this position. Arthur W. Burney, Assistant Chief of Engineering, was advanced to Chief of Engineering.

The vacancy in the position of Superintendent of Acadia National Park, Maine, resulting from the death of George B. Dorr, was filled by the advancement of Assistant Superintendent Benjamin L. Hadley.

Blair Ross was advanced from superintendent, Shiloh National Military Park, to fill the position of superintendent of Great Smoky Mountains National Park vacated by the retirement of Ross Eakin because of illness and disability. James W. Holland, custodian of Andrew Johnson National Monument, was placed in charge at Shiloh. Chief Ranger Wallace Stephens of Shenandoah National Park was advanced to the custodianship of Andrew Johnson National Monument. Dr. A. R. Kelly, custodian at Salem Maritime National Historic Site, and William W. Luckett, custodian at Ocmulgee National Monument, exchanged positions.

Col. David C. Chapman, former chairman, Tennessee Great Smoky Mountains National Park Commission, who took an important part in the establishment of the park, died on July 26, 1944.

LEGISLATION AFFECTING ANTIQUITIES ACT

Five bills designed to modify or abolish the Antiquities Act of June 8, 1906, are pending in the Seventy-ninth Congress. House bill 409, introduced by Representative Fernandez, would amend section 2 of the act to require congressional concurrence in the establishment of national monuments of more than 10,000 acres; House bill 1507 was introduced by Representative Chenoweth and House bill 2110 by Representative Barrett to repeal section 2 of the act and thus take away the President's authority to proclaim national monuments on Federal lands; Senator Robertson's Senate bill 664 would require approval by the governors and a majority of the congressional delegations of the States effected before the issuance of national monument proclamations pursuant to the act; House bill 1112 was introduced by the late Representative O'Connor to repeal the Antiquities Act. Reports were prepared on all of these bills, but congressional action has not been taken on any of them.

JACKSON HOLE NATIONAL MONUMENT

The past year was marked by two important events in the controversy over the establishment of Jackson Hole National Monument on March 15, 1943. Last February, the validity of the monument's establishment was upheld in Federal District Court in the suit, *State of Wyoming* v. *Paul R. Franke.* A bill to abolish the monument (H. R. 2241), introduced by Mr. Barrett of Wyoming, was passed by both houses of Congress, but was vetoed by President Roosevelt who, on December 29, 1944, issued a memorandum outlining the reasons for his conviction that status as a national monument provides for use of this land in a manner best serving the national interest.

In the Seventy-ninth Congress, Representative Barrett has introduced House bill 2109 to abolish Jackson Hole National Monument and House bill 2691 to transfer the public lands in the monument to the United States Forest Service for administration as national forest lands. Senate bill 664, by Senator Robertson of Wyoming, amending the Antiquities Act, is so framed that, if it became a law, the monument would be abolished. Representative Peterson of Florida has introduced House bill 1292, which provides for payments in lieu of taxes to the county where the monument is located, and for the continuance of grazing and other permits within the monument, in accordance with assurances already given by the Secretary of the Interior.

No funds were provided by the Congress for administration of the Jackson Hole area as a monument, but limited protection activities were authorized. Permits for grazing on public lands within the area, based on use during 1942, were authorized as a departmental measure. During the controversy, considerable space was devoted by the press to its discussion, much of it based on misunderstanding or misinformation. During the past year, however, and particularly after President Roosevelt issued his veto message, there has been increasing editorial comment strongly supporting his action. As an example, the editor of the Blackfoot, Idaho, Bulletin suggested that other editors and officials of interested organizations reexamine the evidence which, in the light of careful study, has caused him to withdraw his opposition and favor establishment and development of the monument. During the controversy, the national monument has received strong support from numerous conservation organizations.

INFORMATIONAL AND INTERPRETIVE SERVICES

Guide and Lecture Service

Naturalist and historian staffs remained at an absolute wartime minimum throughout the year; in fact the demand for interpretive services by visiting personnel of the armed forces together with the requirements of protecting collections and perishable park features, serving as consultants on technical problems, and maintaining libraries, exhibits, and other interpretive facilities kept the greatly depleted interpretive staffs and many of the custodians of smaller areas under excessive pressure. However, special efforts were made to afford guide and lecture service to members of the armed forces in the several areas where military visitors were especially numerous.

At Carlsbad Caverns National Park, the interpretive program was expanded by the development of a self-guiding nature trail and the establishment of a naturalist-conducted caverns trip. In addition, the procedure of handling visitors on trips through the caverns was radically revised, providing for the conduct of smaller groups and reducing the long waits which many visitors previously had to undergo.

Museums

While all museums in the system remained open insofar as reduced visitation and operating staffs permitted, no expansion of exhibits or other interpretive devices and activities was undertaken. Some planning was undertaken in the listing of urgently needed museum developments and the setting up of priorities for these developments on the project construction program.

Investigations

Accurate interpretation, adequate protection of natural values, and wise administrative practices require a considerable volume of research and investigation. Although many research projects with definite objectives can be and have been accomplished through the cooperation of other specialized Federal agencies, universities, scientific institutions, and research organizations, there remain projects necessitating continued observations over long periods of time or having other special requirements which only members of the resident park interpretive staff are in a position to accomplish. Recognition of this fact and the need for this type of research justifies postwar expansion of qualified interpretive staffs with adequate laboratory space and equipment.

Publications

Two publications issued by the National Park Service were particularly timely because of the greatly increased public interest aroused by the war in historical matters dealing with the establishment of this Nation as a land of universal liberty and justice. These publications are entitled, "The Oldest Legislative Assembly in America and Its First State House," and "'James Towne' in the Words of Contemporaries." "The Wolves of Mount McKinley," by Adolph Murie, of the Fish and Wildlife Service, recorded a noteworthy study of animal relationships.

Informational Services

With the approach of the climax in the prosecution of the war, increasing interest in the National Park system was indicated by a growing volume of inquiries regarding the areas under our jurisdiction and the purposes, policies, and administrative practices of the Service. School children sought information on historical areas because the issues involved in the war stimulated their interest in and appreciation of the accomplishments of the men who founded our Nation. A growing restlessness and desire to throw off the fetters of wartime travel restrictions made itself felt through a flood of inquiries from persons planning postwar vacations. Many such requests for information on units of the system came from men in the armed forces whose realization of what these areas hold had been developed by visits to some of the units while in training or while transferring from one assignment to another. Editors, writers, and publishers, anticipating the timeliness of travel articles and books, requested detailed data, photographs, including color transparencies, and checking services in the preparation of numerous manuscripts. Automobile clubs and travel promotion organizations desired quantities of informational literature, not only as a source of information for their files but to distribute in response to the anticipated heavy demand. Departments of foreign governments embarking upon park and conservation ventures and made aware of the National Park System of the United States through contacts established in wartime enterprises, asked for assistance, counsel and details relative to selection and administration of units of the system. Although greatly handicapped by a reduced staff, the Service was able to furnish much of the information desired.

Informational Literature

As a means of aiding the small staff in answering requests for information quickly and inexpensively, a series of location maps, each one showing and describing briefly all units of the system in the area covered, was issued. A few of the informational circulars carrying condensed information essential to intelligent use of the areas were revised, and a limited number of new circulars prepared for unsupplied areas having wartime visitation.

There is need of much more extensive distribution of informational material to public libraries, schools, and newspapers and other publications, so that those who want facts or who wish to present facts can obtain them readily.

THE SERVICE LOOKS TOWARD THE FUTURE

To the question, "What does the National Park Service intend to do now that the war is over?", the answer must be, "We hope to do what we were doing before the war, but to do it better." This presupposes greater capacity, attained partly through wartime experience but principally through augmented funds and personnel. It presupposes also continued, if not increased, public recognition of the importance of the work.

The first problem to be met is that of getting the machinery of full operation into running order, involving a comprehensive program of rehabilitation for the roads, structures, and facilities which have suffered from lack of adequate maintenance during a crisis in which the prosecution of the war took precedence over all other activities. The barest minimum was asked for by the Service to continue essential activities. The field and central office staffs need to be restored to peacetime size as rapidly as possible. Unless enlarged appropriations for the present fiscal year are obtained and rapid rehabilitation is effected, the coming heavy increase in travel will introduce or accentuate serious problems of providing service to visitors and protection to the parks.

It is estimated that an expenditure of approximately $1,200,000 during the next 3 years will be needed to put the park areas into condition for postwar use. A program of such work has been formulated with great care and can be launched at full scale as soon as funds are made available.

Augmented field employment is required to perform the normal services which the public has a right to expect when it visits areas administered by the Service. Protective and administrative forces must be strengthened. Since the visitors desire both to see and to be informed about what they see, it is especially necessary that adequate staffs of naturalists or historians be placed on duty before the upsurge of 1946 vacation travel, so that there may be sufficient preparation for the conduct of their work.

Development

Solutions to certain present and anticipated problems depend not only upon sufficient personnel and funds, but upon adequate physical developments, upon which progress has been at a standstill for nearly 5 years. Over-all development, provided for in master plans which were prepared before the war, and which have been kept reasonably up to date during the intervening years, calls for a great variety of undertakings. It must include certain roads and trails, limited, in accordance with Service and departmental policy, in number and extent to those required to meet legitimate public and administrative needs. It involves public service facilities affording transportation, food, and lodging; essential administrative, protective, and maintenance structures such as offices, shops, museums, storage structures, fire detection towers, employee residences and fences, all carefully designed, located, and landscaped for effective use with a minimum of intrusion into either natural or historic scenes. Good planning for these types of development takes time and thought and it must precede development if irreparable mistakes are to be averted. It cannot be done in a hurry. It is also contingent upon control of land—which points to the necessity of an orderly program for acquisition of private and other non-Federal lands now situated inside the boundaries of Service-administered areas.

Implications of Enlarged Responsibilities

The responsibilities of the National Park Service are increasing both in volume and in diversity. The transfer of national military areas and a number of national monuments to National Park Service administration in 1933; and the passage of the Historic Sites Act in 1936, with the resultant establishment of a group of national historic sites greatly enlarged the scope of the Service beyond what it was when established in 1916; the Park, Parkway and Recreational Area Study Act of 1936; the conduct of cooperative recreational studies for the Bureau of Reclamation and the Corps of Engineers; and, within the past year, the placing on the Service of responsibility for the administration of recreational facilities at Lake Texoma, in Texas and Oklahoma, and at Shasta and Friant Dams in California, have all meant expanded activities and more complicated organization.

The National Park Service is performing these new functions to the best of its ability. Yet there remains a primary responsibility for the integrity of the National Park System, and the Service is determined that no spreading of effort shall detract from the performance of its original duties. The National Park System is an entity which has distinct meaning to millions of Americans. It is important that its identity be maintained; that the basic distinctions in purpose and policy between the system and those other areas which are not a part of it be clearly established and made plain to the public. The work of the Service is being organized with this in view.

OTHER NATIONS SHOW INTEREST

Broadened horizons in appreciation of conservation were recognized in the participation by delegates of many nations to the United Nations Conference for International Organization in memorial cermonies in honor of the late President Franklin Delano Roosevelt. These cermonies were suggested by the Save-the-Redwoods League. Under the majestic redwoods of Cathedral Grove in Muir Woods National Monument, Calif., delegates assembled on May 19 to pay tribute to a great leader, during whose administration not only national park projects but many other conservation objectives were realized. Conference delegates also made pilgrimages to Yosemite, Sequoia, Grand Canyon, and other national parks of the West. They were impressed both with the grandeur of these places and with the governmental policy that assures their preservation for enjoyment. At the termination of the United Nations Conference, seeds of the giant sequoia, the General Sherman Tree, were made available to delegates who desired to take them to their native lands for planting. President Truman, en route to the Conference, spent part of June 22 at Mount Rainier National Park.

Efforts were continued by the National Park Service to stimulate action by the Government of Mexico toward the reserving of an area across the Rio Grande from Big Bend National Park, which would make this an international park. The regional director of region three visited several Mexican national parks in the spring of 1945 and conferred with Mexican officials regarding the Big Bend International Park and the Coronado International Memorial projects.

Correspondence was carried on with officials at work on surveys and organization plans for national parks and national park authorities for England, Scotland, and Wales; with those of Kruger National Park of South Africa; and with park officials of Brazil.

PUBLIC NEEDS TO KNOW ABOUT POLICIES

The National Park Service looks upon itself as the guardian of perhaps the greatest living and testamentary trust ever established. The concept of conservation of a small portion of our land, not for consumption of its natural resources, but for its preservation to minister to the human mind and spirit, because of surpassing grandeur or other special and profound significance, is one almost unique to the United States of America. It is steadily gaining in interest and favor among other nations. Members of our staff returning from service abroad tell us that, even during the war, there has been much thinking and planning along these lines, particularly in Great Britain. Visitors from Latin-American countries report similar interest there.

To meet the responsibilities of its trusteeship satisfactorily, the Service is dependent on congressional support which, in the final analysis, must stem from public support. Both depend primarily upon satisfactory performance of its job and upon evidence that it is meeting the needs of the visiting public. But public approval rests not only on accomplishment but also upon understanding of Service objectives and upon satisfaction with their soundness and with progress toward attaining them.

The Service has been so occupied with carrying out the responsibilities placed on it by law, that it has had scant opportunity to keep the public informed about its fundamental policies. The millions of owners of the system are entitled to authentic information about their estate; why it exists, what it contains, where the units are situated; what principles of management are applied to it and the reasons for them. As travel to the national park system areas increases during the coming years, and more and more Americans enjoy the parks, it is the hope of the National Park Service that it can keep abreast of its obligations to tell the people of the value and the meaning of this great estate.

Information Relating to the National Park System June 30, 1945

Areas (classification)	State	Federal land acres	Approximate visitors fiscal year July 1, 1944–June 30, 1945	Approximate visitors 5-year average 1941–45
National parks:				
Acadia	Maine	28,291.07	12,908	163,470
Big Bend	Texas	691,338.95	2,312	(2)
Bryce Canyon	Utah	36,010.38	12,244	49,753
Carlsbad Caverns	New Mexico	45,526.59	131,338	167,580
Crater Lake	Oregon	160,290.33	44,056	124,999
Glacier	Montana	997,486.80	37,801	88,623
Grand Canyon	Arizona	645,084.31	74,170	196,662
Grand Teton	Wyoming	94,892,.92	20,453	54,885
Great Smoky Mountains	Tennessee and North Carolina.	460,882.46	535,106	756,896
Hawaii	Hawaii	173,404.60	381,914	344,947
Hot Springs	Arkansas	1,019.13	253,996	209,959
Isle Royale	Michigan	133,838.51	4,233	5,177
Kings Canyon	California	452,984.02	37,455	104,564
Lassen Volcanic	do	101,880.41	19,355	54,937
Mammoth Cave	Kentucky	50,547.51	45,576	90,957
Mesa Verde	Colorado	51,017.87	6,439	18,969
Mount McKinley	Alaska	1,939,199.04	(1)	(1)
Mount Rainier	Washington	241,219.92	145,317	284,813
Olympic	do	848,212.30	62,817	73,978
Platt	Oklahoma	911.97	201,124	201,298
Rocky Mountain	Colorado	252,625.87	228,862	392,555
Sequoia	California	385,100.13	64,582	157,826
Shenandoah	Virginia	193,472.98	153,944	394,765
Wind Cave	South Dakota	11,718.17	4,558	10,782
Yellowstone	Idaho, Montana, and Wyoming.	2,213,206.55	93,279	269,545
Yosemite	California	756,294.65	139,701	295,430
Zion	Utah	94,241.06	44,405	94,463
Total		11,060,698.50	2,757,945	4,607,833
National historical parks:				
Abraham Lincoln	Kentucky	110.50	13,491	61,425
Chalmette	Louisiana	29.52	31,631	35,129
Colonial	Virginia	7,057.16	204,189	363,305
Morristown	New Jersey	958.37	114,965	132,760
Total		8,155.55	364,276	592,619
National monuments:				
Ackia Battleground	Mississippi	49.15	(1)	(1)
Andrew Johnson	Tennessee	17.08	14,632	(2)
Appomattox Courthouse	Virginia	968.25	4,150	16,015
Arches	Utah	34,089.94	486	1,581
Aztec Ruins	New Mexico	25.88	4,282	7,459
Badlands	South Dakota	122,812.46	9,917	91,706
Bandelier	New Mexico	27,048.89	7,044	8,174
Big Hole Battlefield	Montana	200.00	1,354	(2)
Black Canyon of the Gunnison.	Colorado	12,040.55	2,681	6,318
Cabrillo [3]	California	0.50	(1)	(2)
Canyon de Chelly	Arizona	83,840.00	427	1,186
Capitol Reef	Utah	33,068.74	(1)	(2)
Capulin Mountain	New Mexico	680.42	11,298	21,269
Casa Grande	Arizona	472.50	10,294	11,772
Castillo de San Marcos	Florida	18.51	136,236	172,926
Castle Pinckney	South Carolina	3.50	(1)	(1)
Cedar Breaks	Utah	6,052.20	6,256	7,906
Chaco Canyon	New Mexico	18,039.39	1,463	1,589
Channel Islands	California	1,119.98	(1)	(1)
Chiricahua	Arizona	10,529.80	4,500	6,878
Colorado	Colorado	18,120.55	10,333	12,508
Craters of the Moon	Idaho	47,540.70	2,684	8,611
Death Valley	California and Nevada	1,850,565.20	14,492	41,802
Devil Postpile	California	798.46	(1)	(2)
Devils Tower	Wyoming	1,193.91	5,165	17,523
Dinosaur	Colorado-Utah	190,801.65	1,835	3,333
El Morro	New Mexico	240.00	464	758
Father Millet Cross	New York	0.01	(1)	(1)
Fort Jefferson	Florida	86.82	(1)	(1)
Fort Laramie	Wyoming	214.41	2,672	4,371
Fort Matanzas	Florida	18.34	2,423	19,921
Fort McHenry	Maryland	47.64	297,263	414,213
Fort Pulaski [3]	Georgia	5,427.39	(1)	(2)
Fossil Cycad	South Dakota	320.00	----------	(1)

See footnotes at end of table.

Information Relating to the National Park System June 30, 1945—Continued

Areas (classification)	State	Federal land acres	Approximate visitors fiscal year July 1, 1944–June 30, 1945	Approximate visitors 5-year average 1941–45
National monuments—Con.				
George Washington Birthplace.	Virginia	393.68	10,894	21,751
Gila Cliff Dwellings	New Mexico	160.00	(1)	(2)
Glacier Bay	Alaska	2,297,456.27	(1)	(1)
Grand Canyon	Arizona	196,051.00	(1)	(2)
Gran Quivira	New Mexico	450.94	376	1,289
Great Sand Dunes	Colorado	36,609.19	4,753	4,775
Holy Cross	do	1,392.00	(1)	(2)
Homestead	Nebraska	162.73	(1)	(2)
Hovenweep	Utah-Colorado	299.34	59	141
Jackson Hole [4]	Wyoming	173,064.62	(1)	(1)
Jewel Cave	South Dakota	1,274.56	(1)	(2)
Joshua Tree	California	655,961.33	9,515	17,961
Katmai	Alaska	2,697,590.00	(1)	(1)
Lava Beds	California	45,867.56	10,082	19,375
Lehman Caves	Nevada	639.31	928	1,822
Meriwether Lewis	Tennessee	300.00	5,023	8,812
Montezuma Castle	Arizona	521.41	3,335	5,373
Mound City Group	Ohio	57.00	(1)	(1)
Muir Woods	California	424.56	131,314	113,068
Natural Bridges	Utah	2,740.00	134	563
Navajo	Arizona	360.00	69	228
Ocmulgee	Georgia	683.48	29,667	37,839
Old Kasaan	Alaska	38.00	(1)	(1)
Oregon Caves	Oregon	480.00	1,369	(2)
Organ Pipe Cactus	Arizona	328,161.73	63,265	37,365
Perry's Victory	Ohio	14.25	47,097	29,359
Petrified Forest	Arizona	85,306.00	44,520	105,721
Pinnacles	California	12,817.77	4,194	11,863
Pipe Spring	Arizona	40.00	546	745
Pipestone	Minnesota	115.08	2,828	2,036
Rainbow Bridge	Utah	160.00	(1)	(2)
Saguaro	Arizona	53,669.24	4,810	8,167
Santa Rosa Island	Florida	9,500.00	456,725	364,527
Scotts Bluff	Nebraska	2,292.15	25,604	50,036
Shoshone Cavern	Wyoming	212.37	(1)	(1)
Sitka	Alaska	57.00	3,956	5,959
Statue of Liberty	New York	10.38	453,150	393,677
Sunset Crater	Arizona	3,040.00	2,496	6,660
Timpanogos Cave	Utah	250.00	20,559	12,678
Tonto	Arizona	1,120.00	3,312	4,844
Tumacacori	do	10.00	7,287	6,481
Tuzigoot	do	42.67	3,236	5,389
Verendrye	North Dakota	253.04	(1)	(2)
Walnut Canyon	Arizona	1,641.62	5,330	8,067
Wheeler	Colorado	300.00	(1)	(2)
White Sands	New Mexico	138,567.36	41,263	51,466
Whitman	Washington	45.84	(1)	(2)
Wupatki	Arizona	34,693.03	489	1,658
Yucca House	Colorado	9.60	8	51
Zion	Utah	33,920.75	(1)	(2)
Total		9,285,679.68	1,950,544	2,217,565
National military parks:				
Chickamauga and Chattanooga.	Georgia and Tennessee	8,146.33	89,903	206,531
Fort Donelson	Tennessee	102.54	8,861	18,164
Fredericksburg and Spotsylvania County Battlefields Memorial.	Virginia	2,420.15	33,865	76,518
Gettysburg	Pennsylvania	2,448.17	122,302	290,813
Guilford Courthouse	North Carolina	148.83	19,866	19,202
Kings Mountain	South Carolina	4,012.00	10,724	12,628
Moores Creek	North Carolina	30.00	2,768	3,918
Petersburg	Virginia	1,310.41	124,684	162,420
Shiloh	Tennessee	3,717.59	65,534	102,315
Stones River	do	323.86	15,045	7,606
Vicksburg	Mississippi	1,323.56	9,190	77,265
Total		23,983.44	502,742	977,380
National historic sites:				
Atlanta Campaign	Georgia	20.96	(1)	(1)
Federal Hall Memorial	New York	0.49	91,238	(2)
Fort Raleigh	North Carolina	16.45	8,950	21,671

See footnotes at end of table.

Information Relating to the National Park System June 30, 1945—Continued

Areas (classification)	State	Federal land acres	Approximate visitors fiscal year July 1, 1944–June 30, 1945	Approximate visitors 5-year average 1941–45
National historic sites—Con.				
Home of Franklin D. Roosevelt.	New York	33.23	(1)	(1)
Hopewell Village	Pennsylvania	6,197.00	69,004	44,885
Jefferson National Expansion Memorial.	Missouri	82.58	31,321	(2)
Manassas	Virginia	1,604.57	4,546	6,345
Old Philadelphia Custom House.	Pennsylvania	0.79	22,701	13,387
Salem Maritime	Massachusetts	8.61	4,631	5,573
Vanderbilt Mansion	New York	211.65	11,058	14,461
Total		8,176.33	243,449	106,322
National battlefield sites:				
Antietam	Maryland	183.32	16,728	18,655
Brices Cross Roads	Mississippi	1.00	(1)	(2)
Cowpens	South Carolina	1.00	(1)	(2)
Fort Necessity	Pennsylvania	2.00	23,834	35,429
Kennesaw Mountain	Georgia	60.00	17,056	14,640
Tupelo	Mississippi	1.00	(1)	1,440
White Plains	New York		(1)	(1)
Total		248.32	57,618	70,164
National battlefield parks:				
Richmond	Virginia	684.44	17,824	(2)
National memorials:				
House where Lincoln died	District of Columbia	0.05	65,082	42,869
Kill Devil Hill	North Carolina	314.40	8,697	29,991
Lee Mansion	Virginia	.50	230,953	233,619
Lincoln Memorial	District of Columbia	.61	626,171	979,172
Lincoln Museum	do	.18	101,335	69,269
Mount Rushmore	South Dakota	1,686.40	37,148	126,427
New Echota Marker	Georgia	.92	(1)	(2)
Thomas Jefferson	District of Columbia	1.20	403,727	(2)
Washington Monument	do	.37	562,852	651,660
Total		2,004.63	2,035,965	2,133,007
National cemeteries:				
Antietam [5]	Maryland	11.36	(1)	(1)
Battleground	District of Columbia	1.03	2,700	2,740
Custer Battlefield	Montana	757.84	14,071	26,498
Fort Donelson [5]	Tennessee	15.34	(1)	(1)
Fredericksburg [5]	Virginia	12.00	(1)	(1)
Gettysburg [5]	Pennsylvania	15.55	(1)	(1)
Poplar Grove [5]	Virginia	8.72	(1)	(1)
Shiloh [5]	Tennessee	10.25	(1)	(1)
Stones River [5]	do	20.09	(1)	(1)
Vicksburg [5]	Mississippi	119.76	(1)	(1)
Yorktown [5]	Virginia	2.91	(1)	(1)
Total		974.85	16,771	29,238
National Capital parks: [6]				
The park system of the District of Columbia.	District of Columbia, Virginia, and Maryland.	[7] 27,790.36	(1)	(1)
Parkways:				
Blue Ridge	North Carolina-Virginia	38,911.50	277,018	370,544
Natchez Trace	Tennessee, Alabama, and Mississippi.	13,648.87	(1)	(1)
George Washington Memorial.	Maryland and Virginia	2,458.68	(1)	(1)
Total		55,019.05	277,018	370,544
Total—National Park System.		20,473,415.15	8,224,152	11,104,672
National recreational area:				
Boulder Dam	Arizona and Nevada	1,680,133.33	298,524	442,328

See footnotes at end of table.

Information Relating to the National Park System June 30, 1945—Continued

Areas (classification)	State	Federal land acres	Approximate visitors fiscal year July 1, 1944–June 30, 1945	Approximate visitors 5-year average 1941–45
Projects:				
Everglades National Park	Florida			
Cumberland Gap National Historical Park.	Kentucky, Tennessee, and Virginia.			
Saratoga National Historical Park.[8]	New York	1,864.60	6,584	20,183
Monocacy National Military Park.	Maryland			
Kennesaw Mountain National Battlefield Park.	Georgia	3,034.21	17,056	14,640
Fort Frederica National Monument.	Georgia		(1)	(1)
George Washington Carver National Monument.	Missouri		(1)	(1)
Harpers Ferry National Monument.	Maryland, Virginia, and West Virginia.		(1)	(1)
Manuelito National Monument.	New Mexico		(1)	(1)
Palm Canyon National Monument.	California		(1)	(1)
Pioneer National Monument	Kentucky		(1)	(1)
Eutaw Springs National Battlefield Site.	South Carolina		(1)	(1)
Coronado International National Memorial.	Arizona		(1)	(1)
Spanish War National Memorial.	Florida		(1)	(1)
Oglethorpe National Parkway.	Georgia		(1)	(1)
Cape Hatteras National Seashore Recreational Area.	North Carolina	74.00	(1)	(1)
Olympic Public Works Project.	Washington	43,358.36	(1)	(1)
Total		48,331.17	23,640	34,823
Grand total		22,201,879.65	[9] 8,546,316	11,581,823

Areas (classification)	State	Federal land acres
Recreational demonstration areas:		
Alexander H. Stephens.	Georgia	940.00
Blue Knob	Pennsylvania	5,136.00
Camden Hills	Maine	4,962.00
Catoctin	Maryland	9,918.28
Cuivre River	Missouri	5,759.00
Custer	South Dakota	20,403.97
Hard Labor Creek	Georgia	5,804.40
Hickory Run	Pennsylvania	13,386.44
Lake of the Ozarks	Missouri	16,195.94
Laurel Hill	Pennsylvania	4,026.00
Mendocino Woodlands.	California	5,425.58
Montserrat	Missouri	3,441.00
Otter Creek	Kentucky	1,373.21
Pine Mountain	Georgia	3,031.68
Recreational demonstration areas—Con.:		
Raccoon Creek	Pennsylvania	5,035.38
Roosevelt	North Dakota	71,652.15
Silver Creek	Oregon	4,092.75
Swift Creek	Virginia	7,604.84
Total		188,188.62
National historic sites in non-Federal ownership:		
Gloria Dei	Pennsylvania	(10)
Independence Hall	do	
Jamestown	Virginia	
McLoughlin House	Oregon	
Saint Paul's Church	New York	
San Jose Mission	Texas	

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[1] Travel figures not available or maintained.

[2] Travel figures available for less than 5 years.

[3] Closed to visitors.

[4] Established by Presidential proclamation, Mar. 15, 1943.

[5] Included in travel figures for adjacent battlefield site, military park, or historical park.

[6] Travel included under "Memorials."

[7] Includes Chopawamsic Area, Va., and Chesapeake & Ohio Canal, Md.

[8] Administered by Service pending final establishment.

[9] Includes 2,250,755 military visitors.

[10] 1.20 acres federally owned; 1.53 acres owned by Old Swedes' Church.

Office of Indian Affairs

WILLIAM A. BROPHY, *Commissioner*[1]

DURING the fiscal year 1945, under difficult conditions occasioned by the war, the Office of Indian Affairs has continued to serve its dominant purpose—to protect the interests of 400,000 Indians and Eskimos in the United States and Alaska, and to aid them in becoming economically independent.

While there have been losses and costly postponements, there have been significant gains also. Owing to servicemen's allotments, to the increased quantity and value of their agricultural products, and to the wages earned by more than 40,000 Indians who have left their reservations to work in various industries, the total income of Indians has been greater than ever before. The acquaintance with a wider world and a higher standard of living acquired by many of the home folk, together with a more alert awareness and increased self-confidence of 25,000 young men and women returning from the armed services, may well prove a powerful stimulus to Indian progress.

A fundamental problem, however, is accentuated by this situation. Even with the most efficient use, Indian resources in some areas are far from sufficient to provide a decent livelihood for all Indians. A portion of the 65,000 who left their homes to fight and work, and who are now returning, can find opportunity on their reservations; but thousands cannot, and thousands of others who remained at home are in the same predicament. Since Indian resources cannot be sufficiently augmented to support the population, which is increasing rapidly, many thousands of Indians must be helped to find economic opportunity and acceptance in the general national economy.

So long as thousands of Indians exist below the subsistence level on poverty-stricken reservations, so long as employment opportunities are scarce, Federal expenditures for program services to Indians cannot be appreciably decreased.

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[1] John Collier served as Commissioner of Indian Affairs until March 1945. William A. Brophy was appointed Commissioner and appointment was confirmed by the Senate the same month.

PHYSICAL RESOURCES

LAND

The Office of Indian Affairs has jurisdiction over more than 56,000,000 acres of land. Of this total, about 7,000,000 acres are classified as agricultural, with a valuation of $90,000,000; forest lands aggregating more than 16,000,000 acres, are worth, including the standing timber, approximately $170,000,000; open grazing lands, constituting some 32,000,000 acres, are valued at approximately $90,000,000. The homes and farm buildings on these lands are so poor, in general, that their value may be assessed at no more than $15,000,000.

Acquisition and Consolidation

As the land base on most reservations is inadequate for the support of the entire population, and much of it is rendered almost useless to Indians by the fractionating process of inheritance, the Indian Service, insofar as possible, has continued its program of land acquisition and consolidation.

During the past fiscal year 157,000 acres of land, formerly opened for settlement but unclaimed, were restored to the Red Lake Reservation in Minnesota, and 12,767 acres were returned to tribal ownership on the Wind River Reservation in Wyoming. In all, 257,000 acres of land were restored to Indian use.

Many tribes have been giving serious attention to the matter of providing land for their returning soldiers, and to this end tribal funds totaling $177,000 were used last year in purchasing 63,000 acres on 12 reservations, some of the acquired land being from Indian estates complicated by heirship. With their own funds the Southern Utes reacquired 40,546 acres at a cost of $83,000. During the year 10 tribes requested authorization to use $250,000 of their funds for the purchase of complicated heirship tracts and lands formerly owned by Indians.

Progress is also being made in the rearrangement of land holdings through the exchange of heirship interests for the right to use tribal lands. For example, on the Rosebud Reservation in South Dakota individuals have returned 21,000 acres of their allotted and inherited lands to tribal ownership in exchange for certificates of interest in the Rosebud Tribal Land Enterprise. By this means members may acquire workable farming and grazing units in exchange for scattered fractional interests. The Enterprise is now managing 38,000 acres of allotted and tribal land, and more than 400 proposed exchanges are awaiting the availability of personnel to complete the transactions.

On Cheyenne River Reservation in South Dakota, the tribe is encouraging its members to convey their lands to tribal ownership in exchange for assignments. All interest in 521 allotments and the undivided heirship interest in 246 allotments were thus conveyed during the past year, and 450 exchange assignments were issued. As a result, many members of the tribe have been enabled to engage in, or to enlarge, farm and livestock operations.

The marked success of this exchange procedure on these reservations reflects the Indians' own understanding of their land-use difficulties; and their efforts to solve their land-tenure problem are being closely watched by other tribes.

Oil and Minerals

Since Oklahoma's first commercial oil well, on Cherokee Indian land, came into production 48 years ago, the restricted lands of the Five Civilized Tribes have produced 459,810,138 barrels of oil, in addition to tremendous quantities of associated dry gas and casinghead gas. In the same time oil lands of the Osage Reservation have yielded 584,347,797 barrels.

The depletion of petroleum resources in Oklahoma is only partially offset by discoveries in other areas, notably on the Wind River Reservation in Wyoming, which produced 2,457,251 barrels in the fiscal year 1945, and on the Blackfeet Reservation in Montana, which yielded 2,028,019 barrels.

The total output of all Indian oil wells during the year exceeded 23,000,000 barrels. There are now 11,400 oil wells on restricted Indian lands, and 6,500 oil and gas leases are in force, covering 1,700,000 acres and involving Indians of 35 tribes in 10 states. Forty-five lease sales were held during the past fiscal year, and more than 1,000 leases were sold.

During the war period, lead and zinc held a high place in the list of strategic minerals, and the mines on restricted Quapaw lands produced some 415,000 tons of lead and zinc concentrates, valued at over $38,000,000. In order to produce this amount of concentrates in a short period of time it was necessary to deplete reserves that would not normally have been mined at such an accelerated rate. At the end of the fiscal year there were 56 lead and zinc leases in force, covering 5,726.59 acres. Production for the year amounted to 78,248 tons of lead and zinc concentrates, which was 23.9 per cent of the production from the Tri-State district.

Forest and Grazing Lands

It is conservatively estimated that there are 35,000,000,000 feet of standing timber on 16,700,000 acres of Indian lands located in 19 States, approximately 80 percent being considered suitable for lumber. This constitutes about 2 percent of the estimated total volume of standing timber in the United States.

Of the 528,472,000 feet of timber cut and removed from Indian reservations during the calendar year 1944, the major portion has been used directly in war production. Many relatively small sales were made to provide timber for as many sawmill operations as practicable, and the sale areas have been selected and controlled according to the principles of sustained-yield management.

The Indians, through their tribal sawmill enterprises, produced approximately 30,954,500 feet of lumber during the past year. These enterprises are located on the Menominee Reservation in Wisconsin, the Red Lake Reservation in Minnesota, and the Navajo and Fort Apache Reservations in Arizona. Production was curtailed to some extent by limited labor and equipment.

White pine blister rust threatens the development of white pine in a control area of 108,870 acres, most of which is located in the Lake States. In cooperation with the Bureau of Entomology and Plant Quarantine, Department of Agriculture, 80,182 acres have been given initial treatment and 48,398 acres have been reworked, Indian women performing much of the labor involved. The pine bark beetles continue to cause considerable loss of ponderosa pine on Indian reservations in the far West. While forest management minimizes the depredations of the beetles, special control programs are necessary. These were not possible during the war, but have been planned for the postwar period.

Fortunately, the weather during last year's fire season was very favorable, and only 885 fires were reported, as compared to the annual average of 1,038 for the past ten years; but the areas affected totaled 127,742 acres, as compared to the annual average of 115,830.

During the calendar year 1944 approximately 44,000,000 acres of forest and open range lands on Indian reservations were utilized for grazing, providing forage for about 9,000,000 cattle months, with a value of approximately $1,900,000. Of this area, 34,000,000 acres were used by Indian stockmen.

Maximum production has been maintained on Indian range lands in keeping with the principles of conservation, and overstocking has generally not been permitted. On the Navajo, Hopi, and Papago Reservations, however, overgrazing continues to be a difficult problem. Range lands on those reservations will not support a sufficient number of livestock to provide a decent living for all the Indians. Consequently the reduction of flocks and herds to the estimated grazing capacity of the land is proceeding slowly.

Soil Conservation

During the war years, farming, of necessity, has been on an exploitative basis. As a result, the nation's basic resource has decreased, and Indian lands have suffered with the rest of the country. The great demand for peanuts, cotton, corn, and other row crops requiring clean cultivation, has resulted in annually increased acreages of these crops. Consequently, pastures and grass-crops have been much reduced, and rotations, that maintain the organic content of soil, have been postponed. Removal of the protective vegetative cover during a major portion of the year has resulted in severe erosion by wind and water.

Through conservation during the past year, soil depletion under row-crop farming in the South and Southwest has been checked to a considerable degree, in spite of limited facilities and decreased funds and personnel. Almost 27,000 acres of Indian lands were contoured; legumes were planted on 22,450 acres; strip-cropping was practiced on 13,670 acres; 4,290 acres were converted to improved pastures; 397 miles of farm terraces were built. Application of the above practices resulted in a 35 percent average increase in yield, which is only a portion of the benefit derived, inasmuch as the soil is retained in place and future productivity is assured.

As a result of the war demand from 1917 to 1921, approximately 200,000 acres of the finest Indian grazing land in the Great Plains were plowed for wheat, and less than 2 percent of it has revegetated satisfactorily. During the past year steps were taken to forestall a repetition of such land destruction as that which produced the dust bowl of the middle 1930's. Insistent demands have been made for plowing virgin sod land for flax, as the growers did not want the land that had been cropped and abandoned during the first World War. The Indian Service has cooperated to the fullest extent in securing additional flax acreage, but only under safeguards that would protect the basic soil resources. Definite soil-conserving practices were specified for each major soil class, with the requirement that land be reseeded to an adapted grass species upon cessation of cropping.

In the great Northwest wheat region, the alternate-year clean-fallow system of wheat farming has been standard practice since the country was settled. Under this system, the soil surface has a protective vegetative cover during only 3 or 4 months out of each 2-year period. As a result, the best one-third to one-half of the rich prairie topsoil has been lost by erosion. Conservation plans now in effect on 633 Indian farms, totaling 130,500 acres, have brought about many desirable improvements. A leguminous cover, instead of clean fallow, has been introduced between wheat crops on 15,000 acres; stubble, loose mulch, and rough tillage are now applied on 43,500 acres; crop rotations are practiced on 66,000 acres; 1,150 acres, formerly plowed each year, have been converted to grass. These changes have increased production, reduced erosion, and are actually restoring soil fertility.

In the Southwest, destructive flood waters have been diverted and spread on 39,150 acres of Indian range lands. This has been a major contribution to the checking of siltation in reservoirs, and has increased carrying capacities by 600 cow years. Improved irrigated pastures, totaling 470 acres, have provided forage for an additional 1,200 cow years. Results from the reseeding of 24,895 acres of range land are not reflected in this increased carrying capacity, but if the seeding is successful, it should provide forage for an additional 600 cow years. Seedings made in previous years, have, however, resulted in increased forage equal to about 300 cow years this season.

It is difficult, if not impossible, to estimate in dollars the loss of soil from Indian land. The reduction in fertility results not only in decreased yields to the farmer, but in the filling of streams and reservoirs. There is ample evidence that the losses have been accelerated during the war; and while the conservation practices here described are helpful, they do not solve the problem involved. A soil restoration and conservation program on an increased scale is in order, and plans have been made to this end.

Land Released for Military Use

During the war, over half a million acres of land passed out of Indian ownership to be used by the Government for air bases, gunnery ranges, bombing practice areas, etc. The permanent loss of so great an acreage would be a heavy blow to Indian economy, and it is hoped that not only the half million acres devoted to military purposes, but additional areas of grazing land also, may be made available for Indian use.

Colorado River Resettlement

Although, by provision of the act of 1865, the Colorado River Reservation was set up "for the Indians of said river and its tributaries," no colonization of Indians from the tributary areas was found feasible during three-quarters of a century, owing to the general desert condition of the land and the lack of irrigation facilities.

With the completion of the Headgate Rock Dam and distribution system at the outbreak of the war, colonization became feasible; and during February 1945, the Council of the Colorado River Tribes adopted an ordinance opening the southern three-fourths of the reservation to colonization by Indians of the Colorado River watershed. During May 1945, the War Relocation Authority returned to the control of the Indian Service about 2,000 acres of subjugated land in the southern area.

The Indian Service entered into negotiations with the Hopi Indians, who had expressed interest in migrating to the Colorado River Reservation, and applications were received from 20 families for permits to occupy 40-acre units to be available September 1, 1945.

EXTENSION ACTIVITIES

Livestock

As only about one-eighth of the total Indian land base may be classified as agricultural, livestock raising is of necessity the chief industry of the Indians. Accordingly, during the past year, as throughout the past decade, it has been one of the principal functions of the Indian Service to aid Indians in increasing the numbers of their stock, in improving its quality, and in establishing efficient marketing methods.

Livestock numbers have been, and are being, steadily increased. In 1932 Indians owned a total of 170,700 beef cattle and 11,300 head of dairy stock. That year total income from sales of livestock and livestock products was $1,229,800. By 1943 the number of their beef cattle had been doubled, their dairy herds had increased to more than 50,000 head, and the total cash income from both was nearly $14,000,000. In the calendar year 1944 the number of Indian-owned beef cattle was 361,300, the dairy cattle numbered 50,700, and the total income from these sources was $15,039,000, while the livestock and livestock products consumed at home had a market value of $7,431,410.

It is a much simpler matter to increase the numbers than to improve the quality of the stock. During the past year continued efforts were made to aid Indians in securing better sires with each successive purchase and in culling inferior animals. As a result, a marked improvement is to be noted in many Indian herds. Some reservations are now operating breeding cattle herds for the production of superior bulls. At Fort Apache and San Carlos registered cows are being artificially inseminated. It is found that about 10 times the normal number of calves may thus be sired by one outstanding bull, and greater uniformity of quality may be obtained.

Improved marketing methods have aided greatly in augmenting Indian income from livestock. To this end cooperative livestock associations have been organized on most reservations, and 149 of these were in operation during the past year. Usually livestock are owned individually, but are managed and marketed cooperatively.

Improving Navajo Sheep

During the past quarter of a century there has been a steady decline in the quality of Navajo rugs because of a diminishing supply of suitable wool. The Indian Service has introduced fine-wooled rams for cross-breeding with native Navajo ewes to increase unit production and improve the quality of wool and lambs for the market. This has resulted in raising the market value of both wool and lambs, but the wool still lacks some of the qualities desirable for hand-weaving.

The laboratory at Fort Wingate, N. Mex., operated jointly by the Bureau of Animal Husbandry of the Department of Agriculture and the Indian Service, is endeavoring to develop a type of sheep better suited to the economic needs of the Navajo Indians than either the fine-wooled or old-type Navajo sheep. Although only three generations of cross-bred offspring have been produced, definite progress has been noted. Last year the average clean-wool production of the cross-bred ewes in the experimental flock was almost 100 percent greater than the 1936 production of the foundation Navajo ewes; but at least eight generations will be required to establish the desired type.

Agriculture

In the Southern and Southwestern States, forage is produced chiefly through the development of pastures. On most northern reservations the critical factor in the livestock industry is the production and storage of feed for the winter months. In 1944, 436,794 tons of forage crops, with a valuation of $4,793,911, were harvested on 396,600 acres of Indian land.

Although Indians in general depend chiefly upon livestock for their cash income, other cash crops have been increasing during the past decade. In 1943, 370,000 acres of cereal crops yielded 3,780,000 bushels. In 1944, only 340,000 acres were planted, but the yield of cereals increased to 4,839,500 bushels with a market value of nearly $5,000,000. Other field crops were valued at $3,682,400, while tree fruits, nuts, and berries, sold and consumed, were worth $775,600.

The Indian Service has continued to stress the importance of gardening. In 1944, 31,800 families raised gardens, the home-consumed produce therefrom being valued at $1,280,000.

Experimental Work at Sacaton

At the United States field station, Sacaton, Ariz., the Indian Service cooperates with the Bureau of Plant Industry, Department of Agriculture, in conducting experimental work on crops in the Southwest. During the war years research work has been modified so as to contribute to war needs as much as possible.

New strains of cotton, developed at the Sacaton station, have contributed millions of dollars to the income of Southwestern cotton growers, and other promising strains are now being worked out. Greater attention is being given to the long staple varieties, such as American-Egyptian and the SXP; and the station is taking the lead in furnishing an adequate supply of reliable seed for growers. Valuable contributions have been made to the knowledge of cotton diseases as a result of investigations at Sacaton. Worthwhile work is also being done with flax, and pasture experiments are being conducted to test the suitability of various grasses, clovers, and other forage plants.

Home Extension Work

The home-extension program of the Indian Service, designed to ssist Indians in making better use of increased production and ncome, operates principally among Indian women. It is concerned argely with food conservation and nutrition, although clothing, sanitaion, living expense budgets, and furniture-making also receive ttention. The responsiveness of Indian women to this type of service s indicated by the fact that food canning has increased from 354,000 quarts in 1932 to 3,600,000 quarts in 1944; while in the same period the drying of foods has increased from 803,700 pounds to 1,590,000 pounds.

4–H Clubs

As the training of youth largely determines the attitudes and ideals of maturity, Indian Service extension workers have continued to promote 4–H Clubs among Indian youth as a part of the national movement. 4–H Club work supplements classroom teaching with practical experience in agriculture, stock-raising, and home-making, and serves to develop leadership among Indian boys and girls. It also aids greatly in persuading parents to adopt improved cultural and farm-management practices. The interest in the movement among Indian boys and girls is evidenced by the increase in enrollments from 3,871 twelve years ago to 12,916 in 1944.

Credit Without Money

The creation of a revolving cattle pool in 1934, as a result of drought conditions, has proved to be a wise and profitable venture. During that disastrous year of grassless ranges, the Government purchased large numbers of cattle to relieve stricken stockmen, and as Indians in some areas had feed and needed cattle, arrangements were made with the Federal Surplus Relief Corporation and the Department of Agriculture whereby high-grade and purebred cattle were turned over to the Indian Service. These were loaned to Indians on contracts providing for repayment in kind; and it was planned that cattle, when repaid, would be loaned on the same basis to Indians on reservations which were not originally included in the program.

The revolving cattle pool began with about 40,000 head. At the end of 1944 more than 60,000 head had been repaid and recontracted, and about 12,000 had been transferred to reservations where the Indians were unable to participate in the program at the beginning. The cattle pool has served to save thousands of America's foundation stock and has enabled about 10,000 Indians to engage in the cattle business.

Money Credit

Adequate financing became available to Indians for the first time when the initial appropriation was made for the revolving loan fund authorized by the Indian Reorganization Act of 1934.

Loans are made by the United States to Indian chartered corporations, unincorporated cooperative associations, and individuals. Funds thus acquired by tribes and associations may be used in making loans to members. Repayments are returned to the fund and become available for further loans. The fund authorized was $12,000,000, and thus far a total of $4,428,400 has been made available. Up to and including the fiscal year 1945 the United States has made commitments aggregating $7,631,712.48. Of this amount $5,533,082.48 had been advanced, while a total of $2,532,798.23 had been repaid.

The repayment record of the Indians has been improving steadily. In 1941 the percentage of delinquencies was 7.64; in the following year it decreased to 4.95; in 1943 it was 3.41. Last year only 2.94 percent of the amount due on loans was delinquent.

ENGINEERING

Construction

Exclusive of irrigation works, roads, sidewalks, landscaping, street lighting, and equipment, the physical plant of the Indian Service consists of nearly 15,000 buildings worth $50,000,000, with a replacement value of twice that amount; more than 400 water and sewerage systems valued at about $8,000,000; 15,000 wire-miles of telephone lines worth approximately $1,600,000; and 181 radio transmitters in a system valued at $60,000.

Since Pearl Harbor, funds and manpower as well as available materials have been insufficient to maintain these facilities in a good state of repair, and it is estimated that more than 6 million dollars will be required to put them in such a condition that a million and a half dollars a year will be sufficient to maintain them. During the past 3 years, funds for repair and maintenance have been reduced to half that amount.

In view of postwar programs, the need for additional buildings is urgent, and the need for new hospitals, schools, cottages, dormitories, utility plants, extensions, and modernizations, will be made the basis of requests for annual appropriations. The greatest present need is for funds to make surveys and prepare plans for necessary postwar construction.

Reservation Roads

The roads constructed on Indian reservations during the past decade have greatly aided the Indians in expanding their food production for war use, and have facilitated the transportation of critical war materials found on reservations, such as timber and various minerals. During the war, only access roads to sources of such materials have been built—a program for which expenditures have exceeded a million dollars.

The capital investment represented by some 18,000 miles of roads and trails on Indian lands is approximately $50,000,000. As a result of inadequate maintenance, it is estimated that the loss on the original nvestment from Pearl Harbor to VE day has been at least $5,000,000. The cost of construction and reconstruction necessary to complete efficient transportation facilities on Indian reservations has not been accurately computed, owing to lack of funds for the necessary surveys; but reservation superintendents report that additional roads are greatly needed.

Irrigation

On many of the reservations, particularly west of the ninety-seventh meridian, irrigated land plays an important part in the economy of the Indians. There are at present approximately 840,000 acres in over 250 Indian Service projects that are supplied with irrigation facilities. About one-fourth of this land is in white ownership. This irrigated area compares with about 4,000,000 acres served by Bureau of Reclamation projects, and with a total of 355,000,000 acres of agricultural land in the United States.

The present investment in Indian Service irrigation projects is about $67,000,000, and it is tentatively estimated that about $93,000,000 will be needed for the completion of facilities necessary to serve a total of 1,650,000 acres of irrigable Indian land. About $30,000,000 of the total investment would be chargeable to power development, leaving an average cost of less than $80 per acre for irrigation purposes.

The value of crops grown on irrigated Indian lands in the calendar year 1944 exceeded $30,000,000, approximately half the total cost of constructing the irrigation projects involved.

The principal immediate need is for the completion of surveys of all potentially irrigable lands, after which the ultimate area of each project can be accurately determined and plans can be formulated for development. During the fiscal year 1946 as much of this work will be done as may be possible within the limitation of available funds and manpower.

INDIAN CLAIMS

The California Land Claims

In December 1944 a judgment was entered in the United States Court of Claims, allowing the California Indians to recover from the United States $5,024,842.34, in partial satisfaction of claims arising from the Senate's failure in 1852 to ratify 18 treaties made with these tribes. Under these treaties the Indians ceded 75,000,000 acres o land, in return for which they were promised definite reservation aggregating 8,619,000 acres. They received only 624,000 acres much of it poor and unproductive land. The judgment finally awarde to them represents the difference between the estimated value o lands, goods, and services promised them under the treaties, and th cost of services since rendered to them by the Federal Government This amount has been placed in the Treasury to the credit of th Indians, to draw interest at 4 percent per annum, and appropriation from it will be authorized by Congress for the benefit of the Indians.

The Menominee Swamp Lands

Litigation concerning the Menominee Reservation, Wis., was settled in June 1945 when the Federal Government paid the State of Wisconsin $1,590,854.50 for 33,870.23 acres of swamp lands within the boundaries of the reservation. When the treaty of 1854 was signed with the Menominees, this land was included in the forest area reserved to the Indians, but the State of Wisconsin claimed prior rights under the Swamp Land Act of 1850. The State's claim was upheld, and in order to fulfill the terms of the treaty with the Menominees the United States acquired the land by purchase, to be held in trust for the tribe. The Indians elected to take the swamp lands rather than a cash payment because the timber on these lands was necessary to maintain their lumber operations on a sustained yield basis.

The Sioux Pony Claims

Reexamination of claims for losses of personal property suffered by the Sioux Indians more than 60 years ago was completed during the year, and it was decided that an additional sum of $101,630 should be awarded to the claimants. A bill to authorize the appropriation of this amount was passed on June 30, 1945. These claims for the loss of ponies, wagons, guns, and other personal property originated during and after the Indian war of 1876, when the Army seized or destroyed the possessions of friendly and neutral Indian bands as well as those of the hostiles. Horses were taken wherever found, and most of the claims presented were for these horses. In 1889 and 1891, the sum of $416,260 was appropriated for the payment of these claims, and in 1932 a further payment of $19,357 was authorized, although many claims were disallowed at that time.

The Northwestern Shoshone Decision

A Court of Claims decision against the Northwestern bands of Shoshone Indians was upheld by the Supreme Court in March 1945. The Shoshones had asked for $15,000,000 in compensation for lands relinquished to White occupation, but the Supreme Court held, in a

5–4 decision, that the Treaty of Box Elder in 1863, which granted rights-of-way across the Shoshone country, did not show intent to recognize Indian title to the territory involved.

The decision was notable for the concurring opinion of two of the justices, who pointed out the inadequacy of judicial decisions in cases of this kind, and in substance called on the Congress to provide other machinery and other remedies. The justices concluded that a moral obligation rests on the whites to do for the Indians "what in the conditions of this twentieth century is the decent thing to do."

An Indian Claims Commission

During January 1945, bills were introduced in the House of Representatives to set up an Indian Claims Commission for the purpose of investigating all Indian claims—legal, equitable, and moral—and disposing of them finally within a period of ten years.

The Indian Office has long urged the creation of such a commission as a means of expediting the solution of a vital problem.

HUMAN RESOURCES

EDUCATION

The war caused the greatest disruption of Indian life since the beginning of the reservation era. Thousands of young men and women left high school to join the armed forces, and hundreds of youngsters took jobs. Thousands of Indian families left the reservations for war employment, usually taking their children with them. Consequently there has been a progressive decrease in school attendance at all levels, as the following table shows:

	1942	1943	1944	1945
Nonreservation boarding schools	6, 513	5, 680	5, 363	5, 550
Reservation boarding schools	5, 609	5, 268	5, 162	5, 730
Day pupils in boarding schools	1, 697	1, 296	1, 348	1, 531
Special consolidated schools	4, 150	3, 409	3, 609	3, 605
Day schools	7, 870	6, 554	6, 346	6, 086
Total	25, 839	22, 207	21, 828	22, 502

Most centers of war industry to which Indian families moved were seriously overcrowded, and housing and school facilities were inadequate. In some places local school authorities discouraged attendance of Indian children at public schools. Indians are not aggressive, and many families have yet to reach the conviction that education is a precious heritage to be obtained for the children at whatever cost to the parents. Therefore a little discouragement was enough to keep many Indian children out of school. In some areas this resulted in an increased enrollment in Federal boarding schools.

The educational field agent, whose duty it is to encourage public school attendance by Indian children, has in many cases extended his responsibility in an endeavor to pave the way for admission of these Indian children into the public schools of the adjacent area. Since there has been no concentrated movement by Indian families, the geographical spread of these newer problems of school attendance has tended to nullify the effectiveness of such endeavors.

Much of this loss of education is irreparable, for most young Indians are not yet ready to place the need for education above the opportunity to earn wages, to marry, or to assume in other ways the responsibilities of adulthood. Therefore it is doubtful if many of the older children will return to the classroom.

On the other hand, Indians in the armed forces have been learning the value of education. Hundreds of young men and women, returning to their homes on furlough, have emphasized the promotional advantage they have enjoyed as a result of vocational training received in Indian Service Schools, or lamented their failure to obtain such training when they had the opportunity. The armed forces have been quick to recognize and make use of the technical skills gained by young Indians in the vocational schools of the Indian Service and in the Civilian Conservation Corps camps. Similarly, those boys and girls who entered war industries on the strength of their vocational training have realized the advantage they possess; and these have advertised on the reservations the need for Indians to make the most of educational opportunities offered in Federal schools.

During the year, the Navajo tribe, the education of whose children has been seriously neglected by the Federal Government, demanded by resolution that the United States fulfill its pledge given in the Treaty of 1868 to provide a classroom and teacher for every 30 children of school age. There are today almost 20,000 Navajo children between the ages of 6 and 18, and the school facilities on the reservation will care for less than 60 percent of them. During the war period the lack of road maintenance and the limitations on tires, gasoline, and school bus replacements have interfered seriously with the maintenance of the day schools. As a result, the largest enrollment ever recorded has crowded into the boarding schools of the area, and it has been necessary to turn away hundreds of children whose parents wished them to have the advantages of education.

Inadequate transportation for students has made it necessary to close day schools on several other reservations. The end of the war may permit the replacement of school buses, and as the transition to peacetime economy proceeds, funds may be made available for the restoration of needed road maintenance and construction.

It is still too early to predict the part which may be played by the vocational schools of the Indian Service in the training to be offered under the several veterans' bills. Nine Indian Service boarding high schools have been accredited by State vocational directors for training under the G. I. Bill of Rights, and under Public Law 16, which covers the retraining of disabled veterans. During the year just past only five of these schools have received enrollees under either of these acts; but, in view of reservation sentiment in many areas, it is believed that an increasing number will apply to the Federal schools in the year ahead.

During the past year half of all the food, both meats and vegetables, used in the Indian Service boarding and day schools, was raised in school gardens, or on school farms and ranches, through the cooperative effort of students, parents, and employees.

During the year four significant publications have issued from the presses of Indian schools: The Hopi Way by Laura Thompson and Alice Joseph; Pueblo Crafts, by Ruth Underhill; Iroquois Crafts, by Carrie Lyford; and Education for Action, edited by Willard A. Beatty, Director of Education. The last-named volume, a compilation of articles from the Bureau's fortnightly publication, Indian Education, presents a summary of the philosophy, policy, and practice of Indian schools.

HEALTH

The United States Indian Service offers medical attention to more than 400,000 beneficiaries of the Federal Government in the continental United States and Alaska. This is the only agency that makes available to its clientele complete medical attention throughout the life-cycle of the individual. The activities of the health service include health education, disease- and accident-prevention procedures, palliative treatments, rehabilitation, and sanitation.

During the fiscal year 1945 there has been increasing community participation in health activities throughout the service; and health councils, representing the people, are active on a number of reservations.

There are at present 77 hospitals and sanitoria with a bed capacity of 4,064. The Indian Service also has contracts with a number of State, county, and private hospitals. During the past year 750,000 out-patient treatments were given, and 40,000 patients were hospitalized with a total of 865,590 in-patient days. Forty percent of the cases involved operations, of which half were major. A conservative estimate of the annual value of these services at current rates would be no less than $15,000,000.

As the Indian Service is not a war agency, war activities and private practice have drawn heavily on its health personnel, temporarily limiting its activities to curative and palliative measures. This situation will improve rapidly in the postwar period.

WELFARE

Despite all employment opportunities, it has been necessary to giv relief to needy Indians. Although the number of cases has been reduced, available funds have been insufficient, and the problem o relief during the coming fiscal year will be even more serious.

Much attention has been given to the matter of rendering necessar services to veterans and to those returning from outside employment The Indian Service makes available to the Indian veteran all information concerning benefits to which he is entitled under veterans legislation, and urges him to take advantage of the provisions whic will help him to continue his education, or to establish himself i business, agriculture, or industry.

During the past year the Territory of Alaska enacted three law removing discrimination against the natives in the matter of mothers pensions, in dealing with juvenile offenders, and in the matter of admission to hotels and other institutions serving the public.

More and more tribes and tribal councils are adopting resolution providing that Indian custom marriage and divorce shall no longer be recognized. In accordance with the request of the Klamath Indian business committee, the Congress passed a law in December of last year which abolishes Indian custom marriage and divorce on the Klamath Reservation.

During the year the State of Iowa enacted a law providing aid to dependent children for Indians of the Sac and Fox Reservation.

Law and order problems have increased during the year, and juvenile delinquency, both on and off the reservations, has become a major problem.

EVALUATIONS

INDIAN RESOURCES

The 56,000,000 acres of Indian lands, constituting about 3 percent of the total area of the United States, are estimated to be worth $260,000,000.

Standing timber on Indian lands, estimated at 35,000,000,000 feet, and valued at approximately $90,000,000, is about 2 percent of the total volume of standing timber in the United States.

No estimate of the value of oils and minerals on Indian lands is available.

Indian livestock, numbering more than 361,000, is worth approximately $40,000,000, as compared with 82,000,000 head for the entire country with an estimated valuation of $5,500,000,000.

The physical plant of the Indian Service is valued in excess of $60,000,000. Roads on Indian lands represent an investment of $50,000,000.

Indian Service irrigation projects serve 840,000 acres of land, three-fourths of which is owned by Indians. This total compares with 28,000,000 acres served by all irrigation projects in the United States, according to the 1940 census report. The present investment in Indian irrigation projects is $67,000,000, to be compared with a total investment of more than $1,000,000,000 for the United States, according to the census of 1940.

SERVICES TO INDIANS

While it is impossible to place a money valuation on all services rendered to Indians by the Office of Indian Affairs, it may be stated with accuracy that for each dollar spent on extension activities in agriculture and stockraising, $46.80 was realized by the Indians in 1944.

Health services rendered to Indians by the Office of Indian Affairs, if paid for at current rates, would cost $15,000,000 annually.

According to the latest bulletin published by the Office of Education, 24,562,473 pupils were enrolled in the public schools of the Nation for the school year 1941–42, with an average attendance of 21,031,322. The total expenditure for that year was $2,067,660,387, and on the basis of average attendance, the cost per pupil was $98.31.

During the same period, 32,658 pupils were enrolled in schools maintained by the Indian Service, with an average attendance of 26,617. Total expenditures for the maintenance of these schools was $4,632,610 and the cost per pupil, on the basis of average attendance, was $174.05. In this connection it should be noted that a rather large percentage of Indian pupils attend boarding schools, where they are fed, clothed, and housed. Also, in practically all Indian Service day schools, it is necessary to serve a substantial noon meal; and, as Indians usually live in poorly developed regions and are scattered over large areas, transportation must be furnished.

INDIANS IN THE WAR

By the Spring of 1945, the number of Indians serving in the armed forces had reached a total of 24,521, exclusive of officers. These were in all branches of the service, in every part of the world. Several hundred Indian women have enlisted in the women's reserves, and almost every reservation and tribe lists members of the WAC, the Waves, the Army Nurse Corps, or the Cadet Nurse Corps.

Indians have won nearly all decorations, including two awards of the Congressional Medal of Honor. The first of these was won by Lt. Ernest Childers, Creek, in 1944, and President Roosevelt presented the second to Lt. Jack C. Montgomery, Cherokee, of Sallisaw, Okla., at the White House in January 1945. The Office of Indian

Affairs has recorded 51 awards of the Silver Star to Indians, 70 o the Air Medal, 34 of the Distinguished Flying Cross, and 50 of the Bronze Star Medal. There are certainly many more which have not been reported.

Pfc. Ira H. Hayes, a full-blood Pima Indian from Bapchule, Ariz., was one of the six men who raised the flag on the summit of Mount Suribachi on Iwo Jima, as shown in the famous photograph by Joe Rosenthal. Many Indians took part in the battles on Iwo Jima and Okinawa, as the casualty lists show.

A Ute Indian, Pvt. Le Roy Hamlin, was with the first group to cross the Elbe River and make contact with the Russian Army, on April 25, 1945. Another Ute, Pfc. Harvey Natchees, wearer of the Bronze Star Medal and the Purple Heart, was the first American soldier to enter the center of Berlin.

Many Indian prisoners of war, released from German camps, have returned to the United States. Among those freed from Japanese prisons in the Philippines was Maj. Caryl Picotte, Sioux-Omaha, from Nebraska, who spent 32 months in captivity. Major Picotte served in the heroic defense of Bataan, where he was recommended for the Distinguished Service Cross and the Silver Star, and was in the "death march" to Cabanatuan prison. Lt. Col. Ernest McClish, Choctaw, who was reported missing in action at the time of the surrender on Bataan, came home after nearly 3 years as guerrilla leader in the Philippines where he helped to organize both civilian and military resistance.

During the past year Indians continued to leave the reservations for jobs in the war industries. Navajos and Hopis provided the manpower for ordnance depots in New Mexico and Arizona. Pueblo Indians traveled to Utah to work in the naval supply depot at Clearfield, returning during the summer months to farm their lands. More than 40,000 Indian men and women annually took war jobs away from their reservation homes.

Indians not only increased food production at home, but contributed to victory by working for the Red Cross and for the war loan drives. Many communities, where cash incomes are small, have made large contributions to the Red Cross, and war bond quotas have frequently been oversubscribed.

In April 1945 more than 400 Aleuts, who had been evacuated from the islands when the Japanese invaded the Aleutians in 1942, returned to their homes. They had been resettled on the mainland, near Juneau and Sitka, where, for nearly 3 years, they worked in canneries and engaged in fishing. The Army and Navy, with the help of Indian Service architects, will rebuild their war-wrecked villages; and Indian Service teachers and special assistants are helping the natives to reestablish themselves in their homeland.

Division of Territories and Island Possessions

BENJAMIN W. THORON, ***Director***[1]

* * *

THE territorial areas of the United States—Alaska, Hawaii, Puerto Rico and the Virgin Islands—are giving accelerated attention to their ultimate political destiny. Believing that these areas should have the opportunity to determine for themselves their political relationship with the continental United States, the Division of Territories has aided in the formulation of policies that conform to each area's aspirations.

The Division assisted in the drafting of the Statehood bill for Alaska which was introduced by Alaska's Delegate to the Congress, E. L. Bartlett. Pending the time that this may become a reality, it has begun a complete revision of the Alaska Organic Act, which has had only fragmentary revisions since 1912 and which in many of its provisions is obsolete, retaining for the Federal Government functions which the territory is well able to perform for itself. The revisions now being drafted would provide for an elected Governor, for additional taxing power in the legislature, for a complete territorial judicial system and for other reforms which would give the territory a political and economic base from which the transition to statehood would be facilitated.

Hawaii's Delegate, Joseph R. Farrington, has also introduced a statehood bill for that territory which the Division helped to draft. As in the case of Alaska, it is felt that a revised Organic Act, extending especially a greater amount of political responsibility to Hawaii, will provide a sensible and logical transition to statehood. Consequently the Division has conducted preliminary studies of the Hawaiian Organic Act, with a view to its reform.

Puerto Rico has a politically mature people who, after 45 years of waiting, also are urging a speedy determination of their political relationship with the United States. Senate bill 1407, in the drafting of which the Division participated, and which provided for an elected Governor and considerably increased local autonomy, failed of passage in the Seventy-eighth Congress. Late in the year, the Senate Committee on Territories and Insular Affairs held hearings on Senator Tyding's independence bill and the Division arranged for Puerto Rican representatives to testify. From this came a new bill, drafted by a joint commission of the Legislature of Puerto Rico, which was introduced in the Senate by Senator Tydings (upon request) as Senate bill 1002 and by Commissioner Jesús T. Piñero of Puerto Rico in the House as House bill 3237. This bill would authorize a plebiscite so that the people of Puerto Rico could decide by democratic means whether they favor independence, statehood or a dominion type of status.

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[1] Resigned effective June 30, 1945, and was succeeded by Edwin G. Arnold.

The Organic Act of the Virgin Islands has been under the practical test of actual usage only since 1936, but in that time various defects have shown themselves which make it short of ideal and the Virgin Islanders themselves have created an Organic Act Reform Committee which is busily engaged in drafting proposed amendments to the act. Among the Committee's proposals which are being carefully considered by the Division is one which would give the Islands a representative in Congress. They alone among United States citizens of territories and possessions do not now have such representation.

Knowing that governmental techniques are acquired only through actual working experience in government, the Division has recommended the appointment of qualified Virgin Islanders to positions of responsibility when vacancies occur. The posts of Executive Assistant to the Governor, Commissioner of Finance, and Superintendent of Schools for St. Croix have all been filled by local persons in the past year.

Greater political autonomy, whether it takes the form of statehood, independence or an intermediate form of status, must rest on a sound economic and social structure to be successful and the Division has aided the territorial areas toward this end.

Major attention was devoted during the year to the formulation of a program intended to implement an order from the late President Roosevelt following his speech at Bremerton on August 12, 1944. In that speech he stated:

> * * * I am going to set up a study of Alaska and the Aleutian Islands as a place to which many veterans of this war, especially those who do not have strong home roots, can go to become pioneers. Alaska is a land with a very small population * * *. I am convinced that it has great opportunities to those who are willing to work and to help build up all kinds of new things in new lands * * *.

A preliminary program was immediately drafted in cooperation with the various bureaus of this Department, and with agencies of the Department of Agriculture, recommending projects in every economic field that show promise of supporting additional population n Alaska. It included such diverse activities as a land classification rogram to aid homestead settlement and experimental fishing operaions intended to "prove up" the undeveloped ground fishery esources. Other parts of the program included the completion of he basic topographic mapping of the Territory, mineral investigations, water resource investigations, planning for the development of the recreational resources, improvement of spawning streams to increase the runs of salmon, an increase in experimental work on the breeding and feeding of fur animals, surveys of roads necessary to postwar development, a number of projects in support of agricultural development, such as soil management and fertilizer investigations, and studies of the economic possibilities of agriculture in Alaska.

A budget for the conduct of the program was submitted to the Congress with the approval of the President, as a part of the First Supplemental Appropriation bill for 1945. This program was rejected as being too ambitious to initiate during the war period. The Division then undertook to prepare a modified study program for inclusion in the regular budget of the Department of the Interior for the 1946 fiscal year, every attempt being made to comply with suggestions made in the course of the previous hearings. However, the modified program did not prove to be acceptable and all funds for the study suggested by the President were eliminated from the appropriation bill. It is still hoped that the major parts of the program may be undertaken.

As a result of the interest stimulated by the President's speech, the volume of inquiries about postwar opportunities in Alaska from people in all parts of the Nation, particularly from men in the armed services, has increased to an average of over 600 inquiries a month. These request detailed information on such subjects as the cost of living, communication and transportation facilities, climatic conditions, business, trade, employment and prospecting opportunities, requirements to practice in professions, and methods of acquiring land in the agricultural regions of Alaska.

The Division has continued to work closely with all Federal agencies functioning in the Territory, as well as with Territorial officials and other agencies within the Department, in planning for the postwar development and settlement of the area.

A program was worked out with the War Manpower Commission under which that agency agreed to recruit civilian workers for The Alaska Railroad to replace the railroad operating battalion which the War Department had made available to the railroad in 1943. The recruitment program was sufficiently successful to permit the removal of most of the military personnel before the end of the fiscal year.

The Division, in cooperation with the Delegate in Congress from Alaska, conducted negotiations with the War Shipping Administration to secure continuation of the wartime waiver of the coastwise navigation law, thus permitting continued service to Alaska by Canadian coastwise vessels so long as the number of American vessels continues to be inadequate to serve the requirements of the Alaska trade. These representations succeeded in securing extension of the waivers.

The Division represented The Alaska Railroad, the Alaska Road Commission and the Alaska Rural Rehabilitation Corporation in numerous contacts with other Government agencies, in discussing and solving problems of labor relations, acquisition of property, establishing priorities for obtaining equipment, and other matters requiring attention in Washington.

The House Committee on Territories secured the enactment of a resolution directing the Committee to investigate the various political and economic problems in Alaska. The Division has worked closely with the Committee in arranging for the investigating trip for the summer of 1945. A member of the Division will accompany the Committee.

After nearly three years under martial law, the Territory of Hawaii in October 1944, had restored to it by Presidential proclamation the privilege of the writ of habeas corpus. The military no longer tries civilians for offenses against Territorial law and except for certain restrictions the citizens of Hawaii have regained their peacetime status. The Division of Territories had long been working toward this end. It early believed that the public safety no longer required government under martial law and urged this view upon both War and Justice Departments.

Through the Division's effort, a number of continental companies will build plants and establish offices in Hawaii during the postwar period so as to take advantage of Hawaii's position for an expanding economic market in the Pacific area.

During the year the Civil Aeronautics Board entertained applications for certificates to operate routes between the United States and Latin America via the Caribbean area, to Asia across Alaska, and to the Orient and Australia by way of Hawaii. As the Federal agency charged with protection of interests of the territories and possessions, the Department entered an appearance as intervenor in the appropriate proceedings on behalf of Puerto Rico, Alaska, and Hawaii.

Patterned partly upon a program known as "BAWI," or "Balance agriculture with industry," which was inaugurated by the State of Mississippi, the Insular Government of Puerto Rico, through its Development Company, is engaged in sponsoring and encouraging the establishment of industries which will supplement the Island's agricultural economy and put its people to work.

Through the War Production Board the Division secured priorities for an $890,000 clay products plant, which will utilize Puerto Rican lays in the manufacture of structural tile, brick, sewer pipe, and other heavy glazed products, as well as dinnerware, gardenware, sanitary ware, etc. Priorities were also secured for the construction and equipping of a paperboard mill which will have a capacity of 8,000 tons of paperboard a year and which will utilize the Island's waste paper and some of the bagasse pulp from its sugar mills to manufacture containers for the bottles now being produced in the new glass plant. Continuing aid to the Insular Government in reaching capacity production in the glass plant, the Division presented the plant's case for additional equipment to the WPB. Final capacity of the plant when all units are in operation will be in the neighborhood of 57,600,000 bottles of 16-ounce weight annually. The plant is one of the most modern in the world and will employ several hundred persons directly and several hundred more indirectly.

The Division, the Insular Government of Puerto Rico, and the Government of the Virgin Islands believe that the American-Caribbean offers attractive opportunities for industrial capital from the continental United States and from the islands to establish new as well as branch plants to supply the sizable local market and the vast markets in South and Central America. Full cooperation is being given the local governments in making these opportunities known. Through these efforts a leather company with its main office in New Jersey is now running a branch plant in Puerto Rico which will soon be employing, if it is not already, more than 700 persons. The Division dealt also with a company from New Jersey which manufactures leather eyeglass cases, a silverware factory in Baltimore, perfume companies in New Jersey and Chicago, a frozen foods company which is interested in quick-freezing Puerto Rico's pineapple, a sausage casing company in Chicago, a bicycle plant in Ohio, a soft drink firm in New York, a watch company, a diamond-cutting concern from Belgium, several rug concerns in New York, a ceramics importer in Florida, an elastic products firm, furniture plants in New York and Chicago, a large citrus-fruit grower in Florida who was interested in securing fancy gift baskets for his products, and a coconut fiber plant.

When War Production Board Order M–388 was being formulated to give priority assistance to manufacturers of medium-priced wearing apparel, it became obvious that the hand needlework trade of Puerto Rico, the Island's third largest industry, would suffer a death blow and that most of the industry's 50,000 employees would be thrown out of work. Director of War Mobilization and Reconversion, Fred M. Vinson, agreed that this would be disastrous to Puerto Rico's economy and requested the WPB to make special provision for the Island. Following prolonged discussions with the WPB and with industry representatives in Washington and in New York, the Division began the allocation of fabrics totaling 17,200,000 yards annually.

So that the Insular Government of Puerto Rico might start its expanded educational and health program, this office worked with the WPB to secure priorities for health subunits and school units. Approval was secured for the latter and 250 new school units will now be made available in the Island.

Arrangements were made with the Geological Survey to assign geologists to Puerto Rico, on a reimbursable basis, to conduct a preliminary survey for oil; with the Fish and Wildlife Service to study fish resources; with the Navy Department for the release by Navy, as surplus to its needs, of the greater portion of the 21,000 acres on Vieques Island, Puerto Rico, previously acquired in condemnation proceedings for naval purposes.

The Civilian Food Reserve Unit of the Division of Territories, working with the Office of Supply of the War Food Administration, during the year procured and shipped to Puerto Rico and the Virgin Islands a total of 503,294 tons of foodstuffs and fertilizers. In accordance with the expressed policy of the Department, the Division has been for a long period returning to the regular trade channels the procurement of many of the food and feed commodities, and is completing final arrangements to discontinue all governmental procurement.

Agreements were reached with the debtors and approved by the Department in 478 hurricane relief loan cases, making a total of 1,704 loans which had been adjusted at the end of the year. Approximately 540 loans require further action. Collections for the year amounted to $137,686.05, as compared with $135,835.05 in the preceding year. The total sum of $913,113.46 has been realized from collections during the years 1938–1945.

Following the policy of delegating controls to the municipalities wherever possible, the Division arranged, at the request of the municipal council, for the community to lease and operate the federally owned St. Thomas Meat Market and Cold Storage Plant in Charlotte Amalie, Virgin Islands. Meats for this plant come principally from the St. Croix abattoir, which is operated under a lease with the St. Croix Livestock Association. During the past year 794 cattle, 277 sheep and 119 hogs were slaughtered at the abattoir and sold as government inspected meats.

The net profit from general operations of The Virgin Islands Co., before income tax, totaled $38,458.46. Approximately 45 percent of the $515,383 of total municipal revenues in St. Croix was paid by the company. Sugarcane cultivation increased 20 percent due, principally, to the Commodity Credit Corporation support payment of approximately 90 cents per ton of cane.

The Division continued to exercise certain fiscal responsibilities in connection with the Philippines. The total of Philippine public funds on deposit in the United States on June 30, 1945, amounted to

$481,218,704.92. During the year, payments in total amount of $26,062,777.81 were made by the Division from funds of the Philippine Government to meet obligations of the Commonwealth.

ALASKA

The year ending June 30, 1945, marked the transfer of military activities from all Alaska to the westward half of the Aleutian Islands. The decommissioning of numerous posts on the Alaska mainland and the reduction of personnel in others together with the cessation of military construction resulted in a sharp drop in economic activity.

The territorial legislature, which met in its seventeenth biennial assembly, passed a considerable body of constructive legislation, some of which had been sought for years. It responded to the rising sentiment for greater Territorial autonomy and self-government by adopting a memorial requesting Congress to grant statehood, and by providing a referendum on statehood for the next general election. It created an Alaska Development Board to meet postwar problems following the precedent established in the 48 States and Hawaii. It replaced the inadequate part-time Commissionership of Health with a full-time Commissioner of Health responsible to a board of five appointed by the Governor and increased the appropriation for tuberculosis care. It recognized the increasing importance of agriculture in Alaska by establishing a Department of Agriculture. It prepared to meet the acute housing shortage and to take advantage of Federal legislation by establishing a Housing Authority. It met the economic problem of two groups of Territorial residents by increasing the maximum old-age allowance from $45 to $60 monthly and by raising the salaries of territorial employees 15 percent, thus approaching, if not quite attaining, the Federal employees' 25 percent differential.

The territorial legislature strengthened the social security program by adopting a retirement act for the territorial school teachers and by extending coverage of the Unemployment Compensation Act. It eliminated one growing obstacle to progress by passing a land registration bill designed to remove the dead hand of vanished ownership from those who had patented lands of mining claims or who had left the Territory and could not be reached. It took epoch-making steps to place the Territory abreast of contemporary thought by outlawing discrimination based on race in public establishments, and likewise abolishing discriminations long existing and sanctioned by government practice and procedure in the Territory's juvenile code and in the law relating to dependent children. The results of this legislative session were extremely gratifying on the whole, indicating an increased awareness of the Territory's needs and its important destiny in the American Union.

Development Requires Federal Aid

Alaska's needs are great because of the Territory's large area, its inadequate communications, its relatively sparse and widely scattered population, when viewed in the light of anticipated migration to the area after the war. This prospective influx is of two kinds. It consists, first, of a great number of Americans, chiefly from the armed services, who hope to carve out a livelihood along America's last frontier. Second, a large number of Americans will want to travel to Alaska for their vacations.

Unfortunately Alaska is unprepared for both groups. For the first and more important category, since they aspire to be permanent residents, it is clear that at present roads, utilities of all kinds, housing, and economic opportunities are inadequate for any considerable number.

For highway construction, for the improvement of its health facilities, for the classification of lands, for the development of agriculture, and in countless other ways, Alaska needs Federal assistance which it has never enjoyed in sufficient measure. Alaska can probably do more than it has done in raising additional revenue for self-development, but the task of caring for a prospective citizenry larger than the existing population is clearly beyond the reach of the Territory with its small number of people and undeveloped resources. The development of Alaska—the farthest North and West continental territory of the United States and of great strategic importance, to make it available for successful settlement by returning non-Alaskan soldiers, sailors and marines, Wacs, Waves and Spars—the opening up of an area one-fifth as large as the 48 States, is a Federal responsibility and requires the prompt, generous, and intelligently directed support of both the Legislative and executive branches of the Federal Government. The prospective visit to Alaska during the summer of 1945 of several congressional committees should be a happy augury of the awakening of this interest on the part of national administration.

Influx of Travelers Expected

As for the second group of Americans, the numerous tourists who may spend their vacations in Alaska, it may be stated that they will find there sensational scenic beauty and wildlife abundance. However, accommodations are lacking to care for even a small fraction of those who will desire to go. They need to be developed jointly by Federal appropriations and private capital. The Federal Government has for years set aside vast areas as national parks and monuments in Alaska, withdrawing them thereby from other use, and as yet has made no appropriations for their development as it has for the national parks and monuments in the 48 States. Federal support is further warranted since the Alaskan economy hitherto has been based almost entirely on industries—gold mining and salmon fisheries—and the tourist industry is clearly indicated as the single most important potential economic development. If the Federal Government does its part, private capital, both from outside Alaska, and within their means from Alaskans, may be expected to do its share in developing tourist business. Highway construction through Federal funds, of which the Territory has never had its fair share, essential also in this connection, is an excellent concomitant to every form of Alaskan development.

Alaska Road Commission

The Alaska Road Commission, which is responsible for the construction and maintenance of all roads and trails throughout the Territory except for roads in the national forests which are handled by the Public Roads Administration, carried out during the year the maximum reconstruction and maintenance program permitted by the funds available. No new highways were built. However, it reconstructed and maintained 2,700 miles of highways, 1,250 miles of sled roads and 4,000 miles of trails.

As the year ended, in conjunction with the Division it was working on a new program for road construction to be requested in its 1947 budget. Additional road construction is vital for some areas of the Territory to make additional lands accessible and to open markets. With prospective increased population, better transportation and communication must be made available.

Funds for the commission's program come from six sources: direct annual appropriations by Congress; reappropriation by Congress of a portion of the Alaska Fund, which is derived from Federal taxes upon the Territory's industries; appropriations by the territorial legislature; moneys allotted by the National Park Service; contributions by individuals, companies and corporations; and transfers from the War Department to cover cost of maintenance work on the Alaska highway.

Of these sources, the most important is direct appropriations by Congress and these must be augmented to make any extension of the program possible.

The Alaska Rural Rehabilitation Corporation

The fiscal year 1945 was a very successful one for the Matanuska Valley Farm Colony. Improvement in the methods of crop selection and marketing facilities is brought about as the farmers become better acquainted with Alaskan conditions. Gross business by the Matanuska Valley Farmers Cooperating Association in 1944 amounted to $1,235,016.92 as compared to $1,017,426 in 1943. Farm products sold through the cooperative increased from $370,000 in 1943 to $437,000 in 1944.

With revitalized interest on the part of the farmers and new personnel in the management of the Alaska Rural Rehabilitation Corporation and the Matanuska Valley Farmers Cooperating Association, the colony should continue to make consistent and satisfactory progress.

The Alaska Railroad

The Alaska Railroad's record of freight and passenger traffic in the fiscal year 1945 no longer recounts steeply rising volume. Rather, the changed war situation in Alaska has caused a reduction of military traffic in practically all areas served by the railroad. Net ton-miles of revenue freight carried were 21.5 percent less than the volume in 1944; however, the ton-miles were more than three and one-half times those in 1939, the last year before war activities affected rail traffic.

Gross operating revenues for 1945 were $8,603,546.36 as compared with $11,289,637.46 in 1944, a reduction of $2,686,091.10, or 23.7 percent. The net income amounted to $1,936,840.79 as compared with $5,242,924.45 in 1944, a reduction of $3,306,083.66, or 63 percent.

The total revenue freight hauled decreased from 627,847 tons in 1944 to 549,248 tons in 1945, a reduction of 78,599 tons, or 12.5 percent. Included in this year's tonnage were 225,887 tons of coal compared with 229,961 tons last year.

The total number of passengers carried was 88,998, an increase of 4,698, or 5.5 percent. Passenger-miles totaled 9,275,913, which was a reduction of 1,605,119 passenger-miles, or 14.7 percent under 1944.

Four river steamers were operated during the season of navigation on the Tanana and Yukon Rivers furnishing service between Nenana and Marshall. Tonnage handled amounted to 17,365 tons, an increase of 12 percent over the preceding year. The Nenana marine ways were enlarged to accommodate all of the floating equipment. A fuel-oil storage tank was installed at Nenana and a barge was converted into a fuel-supply barge.

HAWAII

The cost of the war to Hawaii in terms of expended resources, natural and human, recurring and nonrecurring, is literally incalculable. Its civilian population, swollen during 3½ years of war to a figure in excess of one-half million, cheerfully shared with uncounted thousands of service men and women accommodations and facilities for human subsistence which in other times would have been considered intolerable.

While the general health picture throughout the Territory improved during the year, work strain and congested living conditions undoubtedly contributed to the increased high death rate from tuberculosis. Marked progress on the Federal housing program during the latter part of the year promised to ease this situation.

Military Rule Ends

Although Hawaii's citizens, since the outbreak of war, had accepted with restraint and understanding a period of military rule unique in the history of the Nation, there was general satisfaction at the action of the late President in October 1944 by which the writ of habeas corpus was definitely restored, military authority over civilian activities was further limited, and the trial of civilians in military provost courts was discontinued. However, at the year's end, the 10 o'clock curfew was still in force and civilian mail continued to be subjected to military censorship.

In the Seventh War Loan drive, Hawaii again exceeded its quotas, leading the Nation in per capita sales.

Wartime Dislocations Acute

Increasingly acute adult manpower shortages, estimated at 15,000 for the island of Oahu alone, and nonavailability of heavy machinery for the extension of mechanization continued to handicap the production of sugar and pineapples. Since the start of the war, sugarcane land in cultivation declined almost 30,000 acres, or about 12 percent. About one-fourth of these lands was taken for Army and Navy purposes and the remainder was abandoned because of wartime production difficulties. However, the diligence of the producers and the strenuous efforts of Hawaii's school children combined to keep the percentage of decline in production at a low figure compared with the percentage of loss of lands and labor.

Hawaii's fishing industry was virtually eliminated by the war, although, during the latter part of the fiscal year, the efforts of the Territorial Board of Agriculture and Forestry to reestablish the industry were beginning to show results and it appeared that substantially increased quantities of fresh fish would soon be available to Hawaii's people.

Territorial tax realizations, internal revenue collections, gross postal receipts and bank clearings for the year reached an all-time high, although the increase in nontaxable Federal land holdings and continued declines in revenues from gasoline and motor-vehicle taxes were the cause of concern to the county governments which depend for support on these sources of revenue.

Labor and material shortages combined to delay progress on a number of projects vital to the territorial welfare but the past year saw the completion of a 100-bed addition to Queen's Hospital and a water development project, both of which were partially financed with Lanham Act funds.

Little Wagner Act

The regular biennial territorial and county elections which were conducted last year showed the largest vote in the Territory's history, indicating Hawaii's continuing interest in the processes of free democracy.

Hawaii's second wartime legislative session resulted in appropriations exceeding anticipated revenues by some $19,000,000, indicating the probable necessity for extensive postwar readjustment of Hawaii's fiscal affairs. Much progressive legislation was enacted and approved by the Governor, including requirements for premarital physical examinations and vaccination and immunization against certain diseases, a "little Wagner Act" sponsored by labor, acts strengthening and broadening the scope of the child labor and workmen's compensation laws, acts increasing benefits under the unemployment compensation laws and establishing higher minimum wages throughout the Territory. A veterans' council was established and given a generous appropriation and provisions were made for substantial expansion of the facilities of the University of Hawaii and for improvement of the pupil-teacher ratio in the public schools. An airport zoning law was enacted and a commission was created to study the feasibility of establishing a territorial system of health insurance.

PUERTO RICO

Heading a list of legislative measures acted upon by the sixteenth Legislature at its first regular session, was Joint Resolution No. 1 requesting Congress to define the forms of political status "That Congress may be disposed to grant upon approval of any of them by the people of Puerto Rico." This resolution led to the Tydings-Piñero bill, introduced in Congress in May, which provides for a plebiscite on three forms of political status—independence, statehood, and dominion.

The Governor approved 328 bills passed by the legislature. Major appropriations included $17,500,000 for the Development Company, $15,000,000 for the Development Bank, and a total of $11,232,000 for the Insular Emergency Council (principally for the relief program).

New agencies created included: (1) the Puerto Rico Agricultural Company to encourage the maximum development of the agricultural resources of Puerto Rico; (2) the Coffee Insurance Corporation of Puerto Rico in the Department of Agriculture and Commerce; (3) the Aqueduct and Sewer Service to handle all public aqueducts and sewers in Puerto Rico; (4) the Puerto Rico Labor Relations Board; (5) the Office of Information for Puerto Rico; and (6) an Office of Puerto in Washington.

Estimated total receipts from all sources for the fiscal year were 17 percent less than the previous year. The decrease from the total receipts for the previous year was accounted for primarily by a sharp decline in rum exports which cut United States internal revenue collections returned to Puerto Rico.

Strike Delays Sugar Harvest

The sugar harvest was delayed over a month by an industry-wide strike early in the season. Nevertheless the sugar crop for the year ending June 30, 1945, was 886,100 tons, compared with 723,611 tons for the previous year. The grinding season is being extended through August by which time production for the crop year will probably total 960,000 tons. There was also an increase in the tobacco crop, from 285,000 quintals the previous year to a total of 400,000 for the current fiscal year.

The strike in the sugar industry, which lasted 36 days and involved 140,000 workers, was the most serious labor dispute of the year. It was adjusted when the Commodity Credit Corporation raised the sugar subsidy thus permitting employers to increase the wages of agricultural workers as well as those of mill workers.

The mediation and conciliation service of the insular department of labor disposed of 206 situations involving 353,510 workers, of which 54 ended in strikes involving 140,230 workers.

Birth Rate Increases

The war emergency program has carried on two major types of work relief projects: construction, employing an average of 23,812 persons; and community service, employing 7,800.

The increase in enrollment in all Puerto Rican schools, during the school year, was 25,777, or 7.82 percent. Total enrollment was 335,179. The university had 4,250 regular students enrolled.

The death rate showed a slight increase, from 14.7 per 1,000 to 14.8, while the birth rate rose from 39.6 to 41 per 1,000.

During 1944 the public welfare division provided financial assistance to 27,797 persons.

Civil Service Strengthened

The Civil Service Commission conducted a survey of the status of classified insular government employees and of personnel practices. Twelve thousand positions were described in job analysis sheets, duties and responsibilities analyzed, and the positions allocated to the classes established. A compensation plan was drafted which was enacted into law by the legislature and the salaries for all positions were fixed in accordance with the provisions of the compensation plan.

Industrialization Progresses

The Development Company's glass container plant began operations in January 1945, though work was temporarily interrupted by a strike which occurred shortly thereafter. Substantial progress was made on other projects of the Development Company. A mill for the manufacture of pulp and paperboard was nearly completed. Contracts were approved covering machinery and engineering services to build a wallboard plant and a clay products plant. Pilot plants were established in textile design, basketry, furniture, and handiwork novelties. Studies were made of possibilities of establishing a cotton weaving and finishing plant, a shoe industry, and a meat-packing plant.

War's Impact Heavy

The war toll in Puerto Rico in terms of an upset economy and increased human suffering was demonstrably large, especially in the 18 months following Pearl Harbor. The curtailment of shipping in 1942–43 brought the island to the verge of collapse. The extent to which the process of strangulation progressed is illustrated by the fact that civilian tonnage reaching the island fell from a normal 100,000 tons in January 1942 to a little over 7,000 tons in September 1942.

Fortunately, September 1942 turned out to be the low point. In the following months shipping to the island was gradually increased until, by the late spring of 1943, it could be said definitely that the crisis had passed.

The shipping shortage had drastic, immediate, and long-term effects. Of the three principal food items—rice, beans, and codfish—codfish was unobtainable for a considerable period, supplies of rice were exhausted for several months, and beans, throughout, were very scarce.

On the industrial side, the disruption of shipping had an immediate and serious effect. Lacking space to bring bottles down and send bottled rum back, the rum industry faced complete stoppage for the duration. This was averted by the use of small boats. The volume of needlework fell off from a value of $10,646,000 in 1941 to $8,579,000 in 1943. Irregularity of schedules, as well as lack of space, caused continental operators to send their materials elsewhere for processing.

The long term effects of the shipping shortages were felt in agriculture—principally in sugar and tobacco. Both of these crops require large amounts of fertilizer, practically all of which is imported. Scarcity of fertilizer materials and lack of shipping space reduced fertilizer imports and the results in decreased sugar production came in succeeding years after the shipping problem had been solved.

The war brought a rapid increase in unemployment. With the liquidation of the Work Projects Administration in December 1943 the insular government was forced to assume responsibility for direct and work relief. Since then more than $50,000,000 of insular money has been appropriated for this purpose.

THE VIRGIN ISLANDS

World War II demonstrated that the price which the United States paid for the Virgin Islands is more than adequately compensated by their strategic value in the defense arch protecting the Caribbean Sea approaches to the Panama Canal.

This year, as the war moved swiftly toward the end, Virgin Islanders turned their thoughts to the cushioning of their economy. Some of the effects of the temporarily disrupted harbor activities in St. Thomas were offset during the past 2 years by the suddenly expanded activities of the rum industry. Recently the harbor of Charlotte Amalie has begun to show signs of a recurrence of its once healthy activity as neutral ships again are permitted to call here for bunkering.

Transportation to the islands was improved when a Puerto Rican airline, servicing the Virgin Islands and Puerto Rico, leased the new, modern, and fast air equipment of one of the large national airlines, and when an American airline recently extended daily air service from the mainland to St. Thomas.

St. Croix this year produced 4,040 tons of raw sugar while 3,200 tons of cane were processed for rum. The Virgin Islands Co., operating St. Croix's only sugar mill and one of its two distilleries, continues to be the substance as well as the nucleus of the island's economic life.

Islands Look to Public Works

The postwar program for the Virgin Islands has centered around the projected construction by the Federal Works Agency of public works, health and sanitation facilities for which Congress, by Public Law 510, approved December 20, 1944, authorized appropriations totaling 10 million dollars. An initial appropriation was made for plans and specifications and it is hoped that an appropriation of the first 2 million dollars will be made within the next few months, permitting construction to begin early in 1946.

Birth Rate Highest On Record

This year the general health of the islands has been good and epidemics have been scarce. The birth rate for the calendar year 1944 was 43.4, the highest on record; the death rate was 16.3, a slight increase over the preceding year, but still lower than in any previous recorded year, and the infant mortality rate was 101.2, higher than in the preceding year.

Finances and Services Improved

The economic and financial trends indicate an inevitable decline from the prosperity in both islands in the fiscal year under review. The revenues of the municipality of St. Thomas and St. John were

$1,257,416.53, a decrease of 22.27 percent. In St. Croix, the revenues were $515,383.28, an increase of 96.20 percent over the preceding year, the largest revenue in its history, due directly to the rum profits of the Virgin Islands Co. As a result, long-neglected municipal services were improved. Prospects of revenues, for the coming fiscal year, however, are not bright in St. Thomas and St. John, and St. Croix faces an acute situation.

The department of social welfare in St. Croix distributed minimum monthly grants of $2.50 to more than 400 indigents. These grants were once as low as $1. In St. Thomas comparable grants of $5 were made to a like number of indigents. There was considerable improvement in the social services, especially in child-welfare work. Unemployment in both islands was relieved in great measure by local public works appropriations.

By June 30, 1945, there were 688 inductees from the Virgin Islands in the armed forces. In most instances, their military pay plus allowances to dependents exceeded previous family incomes.

Increased Self-Government Recommended

A definite policy on political status should be developed for the islands. Every effort must be concentrated on helping the islanders develop the governmental techniques which will enable them to assume increasing responsibility in the management of their local affairs and in helping them increase their economic self-sufficiency. In addition to the Department of the Interior's policy of employing qualified local persons whenever they are available for Federal positions in the islands, certain features of the Organic Act should be amended. Suggestions for such amendments are now being drafted by a local committee.

THE PHILIPPINE ISLANDS

Following the American landings in the Philippines, the highest officials of the Japanese-sponsored puppet government were transferred from Manila to Baguio. Most of these men were captured and are now held in the custody of the United States Army pending trial after the war by the Commonwealth Government on charges of collaboration with the enemy. Three of these officials escaped in Japanese planes to Tokyo—José P. Laurel, the so-called President of the puppet Republic; Camilo Osias, Secretary of Education and ex officio President of the Kalibapi (the Japanese sponsored Fascist Party), and Benigno S. Aquino, Director-General of the Kalibapi and Speaker of the puppet National Assembly. Manuel A. Roxas, recently chosen President of the Commonwealth Senate, who had also been transferred to Baguio, was released from custody by the military authorities as an unwilling office holder whose loyalty to the Philippines and to the United States had been thoroughly established.

While the great mass of Filipinos have heroically resisted the Japanese during the occupation, it is a matter of concern to the United States that those individuals who have taken leading parts in the puppet regime are for the most part men who were formerly high in the councils of the prewar Philippine Government. On this subject the late President Roosevelt stated on June 29, 1944, that "those who have collaborated with the enemy must be removed from authority and influence over the political and economic life of the country."

After the recapture of Manila in February 1945, General MacArthur formally restored to the Commonwealth Government "full powers and responsibility." Immediately President Sergio Osmeña set about reestablishing the executive and administrative functioning of the national government. He did not call into session the legislative branch, which was involved in an extraordinary situation, until June 9, 1945, after his return from an urgent trip to the United States.

The possible political implications of the status of the present Philippine Legislature are obvious and, in the light of President Roosevelt's statement, of deep concern to the United States. On June 9, 1945, when the special session convened, only 13 were available in the entire Senate; and of the 24 original members, all but 17 are known to have been connected in some capacity with the puppet regimes. If conditions in the Philippines, however, are stable enough to hold the election planned for November 1945, the Filipino people will have an opportunity to choose a legislature to its liking with the possible exception of the third of the Senate allocated 6-year terms.

Occupation Leaves Problems

In view of the imminence of independence and the economic and financial bankruptcy of the Philippines, the United States Government is deeply involved in the future welfare of the Islands. American reoccupation has found the sugar industry paralyzed, many mills destroyed or damaged, hardly more standing cane in the fields than should be saved for seed, and with less than half of the necessary work animals surviving. Members of the industry estimate that before the war sugar supported, directly or indirectly, about 4 million of the Islands' 17 to 18 million population. Reconstruction of this industry is largely dependent on American decisions as to future trade preferences and war damage compensation.

The Japanese occupation has saddled the Commonwealth with a mass of currency problems. The Japanese had put into circulation some 40,000,000 pesos ($20,000,000) in Philippine bank notes previously redeemed by the Commonwealth, which they found in the vaults of the treasury, and against which there is no reserve. An unknown quantity of treasury warrants had been issued in the name of the Commonwealth by the puppet government. After the fall of Manila, President Quezon had authorized branches of the Philippine National Bank in areas not yet occupied to issue emergency notes and Emergency Currency Boards had been empowered to issue local currencies up to the amounts of unencumbered provincial balances in the bank. As the occupation period stretched out and the need of funds grew, various units of the resistance forces issued scrip under their own civil affairs administrations. There are unknown quantities of the old prewar peso still in circulation and, added to these various currencies for which the Commonwealth has more or less responsibility, the American armed forces brought with them the new victory peso with which it pays United States troops, Filipino labor, etc.

The end of the occupation period also found the Islands flooded with Japanese pesos and suffering violent inflation. Although these notes were declared null and void upon the return of Commonwealth authority, the great increase in other currencies remaining in circulation—augmented by heavy expenditures of American forces—has combined with the dire scarcity of food, clothing, and the essentials of daily living to sustain inflation and a widespread black market.

The foregoing are illustrations of but a few of the many critical problems with which the Filipino and American people are faced as a result of the war. Statesmanship of a high order on both sides will be required to solve them.

THE EQUATORIAL ISLANDS

Although war in the Pacific terminated the Division's field development project on the islands of Baker, Howland, and Jarvis in the equatorial group, the use to which the islands were put by the United States armed services proved conclusively the value of such pioneering work. Early in the war the air strip which had been built on the island of Howland for a possible emergency landing by Amelia Earhart was destroyed by the Japanese. The Army moved into Baker in force in 1943 and constructed a Marston Mat air strip. The installations on Jarvis were rendered useless by a United States destroyer in order to prevent their possible utilization by Japanese forces.

The islands of Canton and Enderbury, which the United States holds in condominium with Great Britain, also played an important part in the war. At Canton the air facilities were greatly expanded and the island will undoubtedly remain an important link in trans-Pacific air routes.

Puerto Rico Reconstruction Administration

BENJAMIN W. THORON, ***Administrator*** [1]

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THE Puerto Rico Reconstruction Administration was established by Executive Order No. 7057 of May 28, 1935, to "initiate, formulate, administer, and supervise a program of approved projects for providing relief and work relief and for increasing employment within Puerto Rico." President Roosevelt emphasized that the main objective of the program should be permanent reconstruction of the island's economy in terms of agricultural rehabilitation, rather than mere temporary palliative relief. For this purpose funds aggregating approximately $70,000,000 were made available to the Puerto Rico Reconstruction Administration by allotments from appropriations contained in the Emergency Relief Appropriation Act of 1935 and later relief acts, and by direct appropriations for the Puerto Rico Reconstruction Administration through the fiscal year 1941. Thereafter financing has been exclusively through funds allotted by the President out of the Puerto Rico revolving fund. That fund created by the act of February 11, 1936, consists of income and the proceeds of the disposition of property derived entirely from the Puerto Rico Reconstruction Administration's operation of projects which were financed with funds originating in the Emergency Relief Appropriation Act of 1935. The advent of the Work Projects Administration in the island, large expenditures for defense and war activities, and assumption by the insular government of much of the responsibility for the employment relief had removed the necessity for large expenditures by the Puerto Rico Reconstruction Administration which existed when it was the only agency equipped to alleviate the ever present unemployment problem. Accordingly the comparatively small amounts which have been available to the Puerto Rico Reconstruction Administration each year since 1942 out of the revolving fund have necessarily limited the Puerto Rico Reconstruction Administration's activities principally to protection of investments previously made, and to conservation of the most essential features of its former broad program of rural rehabilitation.

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[1] Resigned effective June 30, 1945, and was succeeded by Edwin G. Arnold.

Expenditures during the fiscal year 1945 out of the Puerto Rico revolving fund were authorized by the President for the following projects:

Operation and maintenance of housing projects	$225, 000
Management of lands and leases connected with the Lafayette project	68, 000
Operation of Castaner farm project	56, 500
Supervision of and making and servicing of loans to cooperatives	97, 000
General administration	160, 000
Construction of rural houses, etc	400, 000
Operation of Central Service Farms	150, 000
Subdivision and sale of lands in Lafayette district for food crop production	13, 000
Purchase of 5 small parcels of land in San Sebastian	324
Storm-water sewer and drainage at the Eleanor Roosevelt development	20, 500
Total	1,190,324

A summary of the year's principal activities, differing little in essential features from those of the preceding 3 years, follows:

HOUSING MANAGEMENT

Rental collections amounted in round figures to $343,000 as against the outlays authorized for management and maintenance of $225,000. This income came from the Puerto Rico Reconstruction Administration's 1,210 urban family dwelling units, nominal rentals from 4,610 rural parcels of about 3 acres each on which no houses have been built, 6,254 rural houses built in previous years, and 235 additional rural houses constructed during the year. Transportation and shipping difficulties in procuring some needed materials prevented completion of all of the houses planned, but the 235 constructed added 700 acres of formerly unproductive land to the raising of subsistence crops by resettled farm laborers as a supplement to their meagre work earnings. All of the urban houses and 98.6 percent of the rural homesteads were occupied as of June 30, 1945. Under the policy of encouraging tenants to become owners, 312 occupancy agreements in the urban zone and 4,526 in the rural districts had been converted by June 30, 1945, into long term purchase agreements. Final conveyances of 40 parcels without houses and of 5 rural homesteads were executed.

RURAL REHABILITATION

Like the 6,489 rural houses and their adjacent parcels devoted to the cultivation of minor food crops, the Central Service Farms project is a most important part of the Puerto Rico Reconstruction Administration's continuing rural rehabilitation program. The insular government through its war emergency program added $42,132.86 to the

$150,000 in Federal funds provided for this project. This made it possible to increase the food supply and the income of the island by the planting of approximately 16,000 acres in subsistence crops and 3,500 acres in cash crops on lands of the Federal Government occupied by the Puerto Rico Reconstruction Administration resettlers. Agronomists gave the resettlers constant advice and supervision in the cultivation, harvesting and marketing of these crops. Seeds produced on 322 acres of beds in the seven Central Service Farms and fertilizers and insecticides were distributed to needy resettlers. These resettlers were not paid for labor on their own parcels, but were paid for work performed in cultivation of the Central Service Farms proper, for the repair and maintenance of intra-farm roads, and for labor in operating and maintaining the Puerto Rico Reconstruction Administration's 37 rural waterworks systems which supply potable water gratis to rural dwellers.

The Castaner project, undertaken several years ago to demonstrate that a large coffee plantation can be made self-sustaining by proper land utilization, soil conservation and crop diversification produced $56,750.94 from the sale of citron, vanilla, coffee, sugarcane, and various minor crops, while furnishing employment to members of more than 200 rural families resettled on one- and two-acre subsistence parcels. In addition to the two 30-bed rural hospitals mentioned in last year's report as established at the Puerto Rico Reconstruction Administration's Castaner and La Plata projects by the National Service Board for Religious Objectors, health units have been opened and are being operated to serve the residents of the Puerto Rico Reconstruction Administration's rural rehabilitation projects in the Zalduondo, San Just, and Comerio areas. Under technical supervision of the planning and direction of the work program by the Puerto Rico Reconstruction Administration as authorized by the Director of Selective Service, these adjuncts of the civilian public service camps are providing invaluable health service to thousands of Puerto Rican rural dwellers for whom such facilities were never before available.

COOPERATIVES

Special attention was given to the cooperatives financed by the Puerto Rico Reconstruction Administration which are engaged in the marketing of produce and the production of commodities for war needs. The Lafayette Sugar Mill Cooperative processed 207,000 tons of cane as compared with 179,000 tons the previous year, and sold all sugar produced to the Commodity Credit Corporation. In its subsidiary solvents plant over 5,000,000 pounds of butyl alcohol and acetone under War Production Board allocations was sold for lend-lease and other war requirements. Interest due June 30, 1945, on the Puerto Rico Reconstruction Administration loan of approximately

$3,037,450 was paid in advance, and shortly after the end of the fiscal year the cooperative paid $250,000 on principal, although no amortization installments are due until June 1947. However, due to the termination of lend-lease and the uncertain postwar commercial demand for the plant's butyl alcohol and acetone, their production has been stopped and plans for conversion of the plant to the manufacture of industrial alcohol are under consideration. The Los Canos Sugar Mill Cooperative processed approximately 200,000 tons of cane, paid interest accrued and $54,000 of its principal debt to the Puerto Rico Reconstruction Administration under a refinancing arrangement, with the balance of $936,000 payable in annual amortization installments of approximately $50,000 including interest beginning June 30, 1946. Five vegetable-marketing cooperatives previously organized and financed by Puerto Rico Reconstruction Administration increased their volume of business to approximately $500,000 from $300,000 for the fiscal year 1944 and $100,000 for the fiscal year 1943. All met installment obligations to the Puerto Rico Reconstruction Administration on time and one paid 4 years in advance. Two additional vegetable marketing cooperatives, one at Corozal and the other at Barranquitas were organized and financed with Peurto Rico Reconstruction Administration loans totaling $29,000. The Cotton Growers Cooperative Association, to which at one time loans aggregating $125,000 had been made, reduced its existing $63,750 loan to $30,000, having sold 1,756,466 pounds of Sea Island cotton during the fiscal year. The Sociedad Agricola which purchases farm supplies for members and patrons, sold approximately $762,000 of fertilizer, feeds, etc. An additional loan of $20,000 was made to the Puerto Rico Rug Cooperative, composed of rural dwellers, and which had a record volume of business amounting to over $122,000. The cooperative organized and financed the previous year and known as the "Cooperativa de Cosecheros de Cidra", processed approximately 1,100,000 pounds of citron during the fiscal year, representing about one-fourth of the island's total production of a product for which previously there was little encouragement. The accounting and operations of all of these cooperatives sponsored and financed by the Puerto Rico Reconstruction Administration are under its constant supervision.

CONCLUSION

For the continuation during the fiscal year 1946 of projects similar to those above reported, the President has authorized the Puerto Rico Reconstruction Administration to expend approximately $950,000 out of the Puerto Rico revolving fund. On June 30, 1945, the unobligated balance in this fund was approximately $2,650,000. Anticipated deposits to the revolving fund during the fiscal year

946 and succeeding years in proceeds derived from projects financed with what were originally 1935 funds, will be somewhat less than the amounts required each year to continue the Puerto Rico Reconstruction Administration's present limited program. Accordingly in a few years the revolving fund will be so depleted that some other source must be found for conserving the social and economic benefits which would be lost if the program were entirely terminated. It is unquestionably true that large expenditures either of insular or Federal funds must be made for many years to come if the permanent reconstruction of the island's distressed economy which President Roosevelt set as a fundamental objective is to be accomplished.

War Relocation Authority

DILLON S. MYER, *Director*

* * *

THE most important turning point in the comparatively short history of the War Relocation Authority program came toward the end of 1944. On December 17 the War Department announced the revocation of the mass exclusion orders under which it had evacuated all persons of Japanese descent from the West coast area in 1942 and through which it had prohibited their return to that area (except under special military permit) for almost 3 years. Basing its action primarily on the satisfactory progress of the war in the Pacific, the War Department immediately replaced the wholesale exclusion with a greatly modified system of control under which it continued to exclude only those individuals of Japanese descent whose personal records appeared to warrant such restriction. The revocation, designated to take effect on January 2, ended the wartime ejection of the great majority of West coast Japanese from their former homes and marked the beginning of the end of the War Relocation Authority program.

The War Relocation Authority which had been maintaining relocation centers as temporary shelters for the evacuated people and meanwhile helping as many as possible to become reestablished in normal communities outside the western exclusion zone, immediately took steps to realign its basic operations. First, it broadened the scope of its resettlement activities to take in the former evacuated area and thus cover the entire United States. Second, it made plans to speed relocation movement from the centers in order to close all centers except Tule Lake within 6 to 12 months. Third, it abandoned all processing of evacuee records for leave clearance and abolished its leave regulations, with the result that all center residents, except those specifically designated for detention by the War Department or the Department of Justice, were free to leave the centers at any time.

With these changes, the Authority was ready for the first time to move definitely toward ultimate liquidation of all its operations. When the revocation order took effect on January 2, there were slightly over 80,000 persons of Japanese descent still residing in the

9 War Relocation Authority centers, including the Tule Lake Segregation Center of northern California. Over 35,000—or nearly one-third of the total group that had come under War Relocation Authority's custodianship—had left the centers over a period of more than 2 years to take up residence in cities and towns all the way from Spokane, Wash. to Boston, Mass. Of the 80,000 who still remained, the War Relocation Authority calculated that approximately 20,000, consisting mainly of Tule Lake residents, would be either personally designated for detention by the War and Justice Departments or members of the detainees' immediate families. This left a total of 60,000 who had to be assisted in making the transition back to private life before the end of December 1945. Thus the War Relocation Authority was faced on January 2 with the task of completing in 1 year almost twice the volume of relocation which it had managed over the preceding 2-year period.

Several factors, however, tended to reduce the magnitude and complexity of the job. Aside from the skill which War Relocation Authority personnel had gradually gained in relocation after 2 years of intensive experience, there was the overwhelming fact of the Army's revocation order. No longer was it necessary for the average center resident to choose between remaining in the restrictive environment of a center and striking out into an unfamiliar section of the country; the great majority were now free, if they wished, to return to their former homes. Moreover, public acceptance for people of Japanese descent through the country was probably at an all-time high. The remarkable exploits of Japanese American soldiers in every major theater of war—and particularly on the Italian front—had effectively exploded the old cliche that no persons of Japanese ancestry can possibly be loyal to the United States. The excellent work record and exemplary civic behavior of nearly all resettlers from the centers had served further to dispel previous fears and antagonisms. With employment opportunities still running high and with citizen groups (as well as previous resettlers) working to help relocation in almost every major city of the Nation, the stage was set for a record movement out of War Relocation Authority centers and completion of the assignment within the scheduled time.

In order to prepare for a greatly enlarged volume of relocation and a rapidly dwindling center population, the War Relocation Authority on the day after the revocation announcement revised somewhat drastically its whole program of center operations. All activities except those which were absolutely essential and those which contributed toward relocation were scheduled for termination at the earliest feasible date. Construction was brought virtually to a standstill and even maintenance work was sharply curtailed. Crop production on the agricultural lands of the centers was eliminated entirely except for completion of the winter vegetable program at the two centers in Arizona. All further purchase of livestock was halted and plans were made for full utilization of existing flocks and herds. Announcement was made that center schools would close permanently in June at the end of the academic year. Cooperative business enterprises, operated by the evacuee residents, were advised to start planning at once for eventual liquidation. By the end of June practically all of these changes had either been achieved or were well on the way to realization.

In submitting budget estimates to the Bureau of the Budget and the Congress shortly after announcement of the West coast revocation, the War Relocation Authority forecast that 16,000 of the 60,000 "relocatable" persons who could be relocated and who were residing in centers on January 2 would leave before the end of June. The actual number who relocated during that period was 15,907. Of this number, 4,922 returned to the evacuated zone while the remainder—many of them dependent family members following their previously relocated breadwinners—chose to resettle in other parts of the Nation. When the fiscal year ended, the total number of relocations for the preceding 12 months stood at 24,679 and the cumulative total covering the entire period since establishment of the War Relocation Authority program was 51,412. Of the 44,000 "relocatables" still residing in centers, it was anticipated that fully half would ultimately return to their communities of prewar residence in the far Western States.

RESETTLEMENT ACTIVITIES

Field Organization

One of the first steps which the War Relocation Authority took after revocation of the exclusion orders was to set up a field organization in the West Coast States similar to that which had previously been functioning throughout the rest of the country. Dividing the coastal region into three broad areas—northern California, southern California, and the northwest—the Authority established its principal field offices at San Francisco, Los Angeles, and Seattle. District offices, to handle relocation problems at the local level, were also created in these three cities as well as in 15 others such as Fresno, Santa Barbara, Sacramento, and Portland. Meanwhile the activities of field offices in several other sections of the country were slightly curtailed and four of these offices were discontinued.

Public Acceptance

Except in some parts of the Pacific coastal area, public acceptance of relocating evacuees was not a major problem of the War Relocation Authority during the fiscal year. Of the nearly 20,000 evacuees who left relocation centers for destinations outside the former exclusion zone, less than a dozen reported any serious difficulties of community adjustment, and all of these cases were eventually worked out satisfactorily.

In many communities of California, Washington, and Oregon, however, hostility toward the evacuated people and opposition to their return assumed serious and rather widespread proportions. This was particularly true in the interior agricultural valleys of all three States and in some rural sections along the California coast; acceptance in the major coastal cities, aside from some attempts at boycott of evacuee crops in the produce markets, was generally good throughout the entire period.

After revocation of the exclusion ban, antievacuee feelings, which had been simmering throughout the fall, suddenly erupted simultaneously at several places in the coastal States. At first they took the comparatively harmless (but nontheless reprehensible) form of hostile "mass" meetings, resolutions adopted by various organizations opposing return "at least until after the war," discriminatory signs posted in shop windows, formation of new citizens' leagues specifically for the purpose of working against return, and unfriendly editorials or paid advertisements in the local newspapers.

In the Northwestern States resistance to the return of the evacuees was very largely confined throughout the whole period to these and similar "within the law" types of discrimination. But in several of the California localities, as the evacuee continued to come back in increasing numbers despite such menacing gestures, the hoodlum element among the opposition began resorting to attempted violence and open intimidation.

By the end of June 34 such incidents—involving attempted arson or dynamiting, shots fired into the homes of returned Japanese, and threats of bodily harm—were recorded. The worst spots were Merced and Fresno Counties, with seven shootings each; Orange County, which had six cases of intimidation; and Placer County, which had an attempted arson and dynamiting coupled with a shooting. Fortunately, no evacuee was actually injured in these lawless forays. Property damage, however, was considerable, and the terrorism which prevailed over wide areas of California undoubtedly contributed to the relatively slow rate of return to that State during the first 6 months after revocation of exclusion.

To counteract unreasoning prejudices against all persons of Japanese descent and correct the factual distortions about War Relocation Authority activities which had been disseminated by hostile West coast organizations and newspapers, the Authority undertook a positive program of public information in the far western area several months before revocation of exclusion. Working mainly through and n cooperation with civic clubs, church groups, and similar organizaions, War Relocation Authority field officers tried to reach as many eople as possible with factual information about the agency's aims nd procedures, the status and experiences of the evacuated people ince evacuation, and especially the combat record of Japanese American soldiers. Pamphlets and bulletins, setting forth such inormation, were made available to groups and individuals upon request; explanatory talks were given before dozens of local forums and organizational meetings; motion pictures, dealing with the relocation program, and the Japanese American soldier, were shown; progress reports and other types of information were released to the press.

In this effort, information about American servicemen of Japanese descent proved particularly effective. The almost unparalleled combat record of the all-Nisei One-hundredth Infantry Battalion and Four Hundred Forty-second Regimental Combat Team, the long list of Nisei casualties, and the impressive array of their battle decorations brought home more forcibly than anything else the fact that Japanese Americans are capable of the highest kind of loyalty to the United States and that the families in relocation centers have sacrificed equally with other American families in the winning of the war.

When the pattern of terrorism in California became plainly apparent toward the end of March, a definite system of reporting incidents to the State and local law enforcement officials and to the press, both locally and nationally, was instituted. On May 14, the Secretary of the Interior finally issued a strongly worded public statement condemning the terroristic elements and calling for more vigorous local law enforcement. Approximately 2 weeks later the Secretary took occasion at a press conference to denounce a California justice of the peace who had suspended sentence upon a man convicted of shooting into the home of a returned evacuee. By these means, the public both on the West coast and throughout the Nation was made gradually aware of the insidious manifestations of racial prejudice in California and of the less violent forms of opposition both there and in the Northwestern States. Before the end of June scores of newspapers in all sections of the country had brought the issue of West coast terrorism sharply into focus and had aroused a widespread demand that the returning evacuees be accorded fair and decent treatment.

As the period ended, there were encouraging signs that this heightened public awareness of the issue was having a salutary effect. The tone adopted by many of the opposition groups was becoming progressively milder and more defensive, while several organizations of West coast citizens friendly to the evacuees were growing increasingly active and outspoken. Most significant of all perhaps, the incidents of terrorism dwindled sharply, both in frequency and viciousness, almost immediately after the Secretary's two public statements. In fact, there was no incident of major importance between the Secretary's second statement and the end of the fiscal year.

Financial Assistance for Resettlers

On the day after announcement of revocation the War Relocation Authority sent to all evacuees, both in and out of centers, a comprehensive statement on the types of assistance that would be available thereafter for relocating families and individuals. Travel grants and transportation of personal properties, which had previously been extended only on a showing of need, were made available generally to all persons leaving the centers for relocation. Such assistance was also extended to those who had previously relocated outside the West coast area and who now wished to go back to their States of former residence. Additional grants, to cover the cost of subsistence while traveling as well as expenses during the transition period immediately after arrival at destination, were continued for those resettlers in actual need of such supplemental help.

At each center, however, there was a group of people who needed assistance over and above these types of aid in order to become satisfactorily restablished in private life. This group included those whose family resources had been seriously depleted as a result of evacuation, unattached individuals who were incapable of complete self-support, and families without any prospect of adequate and continuing income. Early in the relocation program, the War Relocation Authority completed an agreement with the Social Security Board for cooperation on a program of financial assistance specifically designed to meet the needs of such people as well as those resettlers who might be faced with a sudden, unpredictable, short-range need for help. This program, actually administered by State and local public welfare agencies, was financed by funds made available to the Social Security Board by the War Relocation Authority.

Before revocation of exclusion, there were comparatively few applicants for assistance under this program among the relocating groups. As the more able-bodied, primary wage-earners left the centers in increasing numbers during 1943 and 1944, however, the so-called "dependency" cases loomed steadily larger in the residual population. Accordingly, when the ban was lifted and plans for closing centers were announced, the War Relocation Authority began almost immediately to intensify and broaden the arrangements which had previously been made for handling dependency cases. Since most of the dependent evacuees could qualify for continuing public assistance only in their States of former residence, first attention was given to working out a satisfactory referral procedure with State and local velfare agencies of the former evacuated area. At the centers staffs f trained welfare workers were geared up to the job of interviewing ll families and individuals who had special problems of support, nalysing their needs, and advising them of the types of assistance or which they might be eligible. Case summaries prepared at the enters were transmitted through the War Relocation Authority field ffices to the State and ultimately the local welfare agencies.

Although the procedure for handling dependency cases was somevhat slow and cumbersome at first, it was streamlined and speeded p considerably throughout the spring. By the end of June, most of he delays had been eliminated, and the War Relocation Authority vas able to plan for the final closing of the centers with full ssurance that no genuinely needy person would be left without dequate means of support.

Employment and Housing

Because of the widespread need for workers of nearly all types, relocating evacuees experienced comparatively little difficulty during the year in finding job opportunities consistent with their individual qualifications. The problem lay, rather, in finding enough evacuees to fill the jobs which were available.

On the West coast, however, the resettlers enjoyed somewhat less freedom of job selection than in other sections of the country. Governmental regulations continued to debar the evacuees from employment in coastal fishing or waterfront work, while one of the more important labor organizations of the region—the International Teamsters Union—adopted a policy of categorically excluding from membership all persons of Japanese descent except honorably discharged veterans. In a few cases individual labor union members resisted working on the same jobs or in the same shops with the returnees and even threatened to strike if the Japanese Americans were hired.

The most noteworthy case of this kind occurred in May at Stockton, Calif., where some members of the International Longshoremen's and Warehousemen's Union attempted to foment a strike in protest against the employment of three returned evacuees. This action was promptly repudiated as contrary to the union's policy both by the international president and by the head of the San Francisco local which had jurisdiction over the Stockton unit. The protesting members were swiftly suspended from membership and were told that the union would tolerate no racial discrimination. A strike was effectively averted and the evacuees continued on the job.

Housing was a problem for resettlers in practically all of the Nation's largest cities and was particularly acute in the metropolitan centers along the Pacific coast. Shortly after the opening of the West coast field offices, intensive efforts were made to encourage the establishment of evacuee hostels in that region similar to those which had previously been operating in other sections of the country. These hostels, usually operated by church groups or other organizations interested in assisting Japanese American relocation, were designed to provide temporary accommodations for resettlers until a more permanent type of housing could be located. Before the fiscal year ended, about a dozen had been set up in principal West coast cities. The War Relocation Authority actively assisted in their establishment by making surplus relocation center equipment—such as bedding, cooking utensils, and the like—available to the sponsors on a loan basis.

Both on the West coast and elsewhere the Authority assigned staff members at its principal field offices to work full time in helping resettlers to locate housing accommodations and marshalled every available resource to overcome this particular problem. By the end of June substantial progress had been made toward the ultimate goal of assuring at least temporary accommodations for every individual and every family group leaving the relocation centers.

CENTER MANAGEMENT

The job of operating emergency-built cities for displaced persons of Japanese descent has never been more than a temporary expedient in the War Relocation Authority program. From the time when the long-range policies of the agency were first formulated in the summer of 1942, the Authority has always looked forward to the day when the evacuation orders would be rescinded and the shelter of the centers would no longer be required. The War Department's announcement of December 17, restoring freedom of movement throughout the United States to the great majority of the evacuees, eliminated in one stroke the center's chief reason for continued existence.

The revocation order did not, however, automatically transport the thousands of center residents to their chosen destinations, and it did not solve overnight all the manifold problems involved in dissolving these complex wartime communities. In order to prevent a chaotic mass movement and allow for individualized relocation planning and assistance, a spaced-out program of center closing was obviously essential. After careful consideration of factors such as transportation, available housing, and employment opportunities, the Authority decided that no center could be closed on a sound basis in less than 6 months but that all (except Tule Lake) should be closed within a year.

Because of the greatly increased emphasis on relocation preparations and the need to keep center management problems at a minimum, a policy was adopted immediately after revocation governing visits that might be made back to the centers by previously relocated evacuees. At first, such visits were permitted only for purposes of completing family relocation plans or for emergency purposes and only with the advance approval of the appropriate War Relocation Authority field office. Later the advance approval requirement was eliminated, and each relocated evacuee was permitted a maximum of 30 days for visiting at the centers without regard to the purpose of the visit.

By the end of June all phases of center operations were well advanced toward final liquidation. Although there were still about 44,000 people to relocate and large amounts of Government property which eventually would have to be inventoried and processed through surplus property channels, the War Relocation Authority had every reason to believe that all centers could be closed by December and was contemplating the definite possibility of closing some at an even earlier date.

Construction and Maintenance

Revocation of the exclusion order brought immediate reduction of the construction and maintenance operations to a minimum, in all centers except Tule Lake, where it was necessary to complete a considerable program of buildings already under construction or planned. Likewise maintenance was pared down to the minimum consistent with efficient operation. By the use of lumber and other materials released through cancellation of many center construction projects, sufficient stock was available for all construction and maintenance, and the building of boxes and crates for the freight of relocating evacuees, without ordering new stocks. This was made more effective by the interchange of materials between the different centers.

Agriculture

During the first half of the fiscal year the agricultural program was in full operation, in accordance with the policy of producing as much of the food needed for the evacuees as possible. But with announcement of the closing date for the eight relocation centers an almost complete reversal was made. No crops were planted in the spring of 1945 with the exception of Poston and Gila, where vegetables could mature and be harvested by June 30. No additional beef cattle or poultry were purchased and the hog breeding program was discontinued. A program for the orderly fattening and slaughtering of the livestock on hand was put into effect. By the close of the fiscal year most of the livestock at the centers had been consumed.

Community Government

Sponsored by the Community Councils of seven centers, an all-center evacuee conference was held in Salt Lake City in February.

Approximately 30 delegates met for a week, discussing problems affecting the evacuees as a result of the opening of the West coast and announcement of center closure. The delegates prepared and approved a letter to the Director of the Authority requesting reconsideration of center closing and submitted a list of recommendations to facilitate resettlement and rehabilitation of those relocating. Although the Authority did not modify its policy on center closing, it gave careful consideration to the other recommendations of the conferees and instituted a number of procedural changes along the lines recommended.

Felonies, misdemeanors, and violations of administrative regulations decreased in all centers, and the general crime rate was small, compared with national rates.

Business Enterprises

Evacuee-operated business enterprises in the centers generally were in excellent financial condition at the close of the fiscal year, with assets on May 31, listed at $1,237,369, or 16 percent lower than 1 year previously. Inventories were reduced during the fiscal year from $872,000 to $429,000 and the cash balance increased from $441,000 to $666,000.

Education

With the end of a vigorous 3-year school program in the centers set to coincide approximately with the close of the fiscal year considerable readjusting was necessary. School enrollment on the elementary, secondary and nursery school levels showed a drop of 2,780 during the year. The elementary and secondary enrollment at the beginning of the year was 18,772, and at the end of the year 16,399. The nursery school enrollment dropped from 1,928 to 1,521. A major part of these declines was the result of relocation. The records of pupils were checked to insure that all outstanding requirements would be met.

Medical Care

During the year there was a marked decrease in the activities of the maternity service as compared with that of the previous year, accounted for largely by the departure of a great many young married people. Total births were 1,745; deaths 541.

When the exclusion order was lifted, there were 700 patients under War Relocation Authority's general custodianship in West coast hospitals, including approximately 250 tuberculosis patients hospitalized there prior to evacuation; 108 mental cases transferred to institutions in their States of legal residence, following commitments from centers, and the remainder, chiefly mental patients hospitalized over a long period. Arrangements were made as of June 30, 1945, for discontinuance of financial responsibility for hospitalization for 343 patients at approximately $900 per day.

A January survey showed there were 190 tuberculous patients in the various center hospitals who would need long-time sanatorium care, and a gradual transfer of these patients to the west coast was begun in the spring. At the same time individual interviews were held with over 200 tuberculous patients in west coast hospitals and reports of these interviews were sent to the appropriate centers in order to further relocation by correlating the plans of the patients with those of their immediate family members.

Fire Protection

With millions of dollars of value and thousands of buildings under their guardianship, fire protection crews at the centers established an enviable record of only 245 fires during the year, with a total loss in buildings and contents of $37,652, of which $25,310 was Government property and $12,342 private property. Granada center recorded only 10 fires; Poston with the greatest number had 48. Manzanar accounted for $19,264 of the total loss of which $19,051 resulted from the burning of three Government warehouses. The smallest loss at any center was $170 at Central Utah.

ADMINISTRATIVE MANAGEMENT

Administrative aspects of center closures involved huge physical assets which must be accounted for and disposed of in an orderly manner. Teams composed of accountants and property experts were sent into the centers where all property records were being put in order, as the fiscal year closed. Surplus properties were listed and a conservation program was adopted which entailed an exchange of materials and supplies between centers. Under this procedure things needed in each center were listed, and where these needs could be filled from the surplusses of other centers, transfers were effected.

Procedures for mess operations were overhauled and a policy adopted that would require the closing down of a block mess hall when the population in a block dropped to 125 residents. This resulted in a considerable saving of manpower and supplies, as many blocks throughout the various centers fell within the scope of the closing order. As a further conservation measure, food stocks which had been carried on the basis of a 60 to 90 day supply, were reduced so that quantities on hand were sufficient for only 20 to 30 days.

A procedure was also developed for the final disposition of all War Relocation Authority records, and the schedule which was recommended to the National Archives and the Congress was given the stamp of approval, and put into effect.

Among other problems which the War Relocation Authority faced during its liquidation period was the question of what would happen to its hundreds of civil service employees. In an effort to find an answer, a personnel survey was conducted in the spring of 1945 to determine possible placement of staff members with other Government agencies. On July 1, 1944, there were 2,284 employees, 2,015 of whom were stationed in the field, while 269 staffed the Washington offices. On June 30, 1945, the total employment was 2,436, an increase of 152, as the relocation program was being developed into its final phases. Most of this increase was in the field, where the total reached 2,154, with 282 in the Washington office.

LEGAL DEVELOPMENTS

Litigation of vital concern to the evacuees, both in and out of the centers, was spread on the records during the year.

On December 18, the United States Supreme Court handed down decisions in the Fred Korematsu and Mitsuye Endo cases. In the former, the legality of the evacuation orders was sustained. In the latter the court held that the War Relocation Authority had no authority to detain and control the movements of citizens who were concededly loyal to the United States. Although the War Relocation Authority in anticipation of War and Justice Department assumption of responsibility for security measures, had been shaping its policies toward elimination of its leave clearance requirements in any event, the Endo decision made it unmistakably clear that detention of citizens solely on the grounds of race or ancestry could not be sustained before the courts.

Land laws aimed at alien Japanese began to crop up in various States. The Oregon Legislature adopted a law making the possession or ownership of land by Japanese and other aliens ineligible for citizenship a criminal offense, and amending the rules of evidence for the trial of cases arising under the State alien land law. A proposed Colorado constitutional amendment to authorize restrictions on ownership of land by aliens failed in a referendum in November. In California, a referendum petition for an amendment to the State alien land law to extend it to "dual" citizens as well as aliens ineligible for citizenship and to the ownership of watercraft as well as land failed for lack of a sufficient number of signatures. This same amendment was introduced in the State legislature at its session which closed in June, but failed to pass. Law enforcement officials in California instituted 28 civil suits to forfeit to the State land alleged to be held by Japanese aliens and the State of Washington instituted 13 similar civil suits.

SEGREGATION CENTER

As it became increasingly apparent that the West coast exclusion would eventually be rescinded and War Relocation Authority leave regulations simultaneously abolished, plans were developed for setting up relocation machinery at the Tule Lake Segregation Center. Under regulations of the Western Defense Command, it was anticipated that quite a large number of these evacuees would be eligible for resettlement on the west coast as well as elsewhere in the United States.

A policy was adopted for Tule Lake similar to that in effect for other centers and by the time the ban was lifted on January 2, the administration was ready. Prior to this time there had been only slight interest in relocation, but in January inquiries began to trickle into the newly established relocation office in the center. The first person to relocate from Tule Lake since it had been designated as a segregation center was a young man who departed for Minneapolis late in the month.

In the period between that time and the close of the fiscal year, 140 persons relocated directly from Tule Lake to outside communities. In addition, approximately 400 residents of Tule Lake who were out on seasonal leave effected permanent departures during this period, or were institutionalized outside, so that a total of more than 500 actually relocated between January 2 and June 30. The population remaining as the fiscal year closed was 17,454.

The fiscal year at Tule Lake got away to a rather turbulent start, with the murder on July 2 of the evacuee manager of the Business Enterprises. This was apparently the culmination of a feud between those evacuees who were willing to cooperate with the administration and those who were not. As a result of the stabbing, the board of directors and all key evacuee personnel of the cooperative resigned. Before the end of July the entire evacuee police force also had resigned, as the investigation into the murder became more intense. The murder was never solved, and the police department was reorganized as the Colonial Peace, to carry on. A reorganization of the Cooperative was also effected, and by the end of July the Business Enterprises were again functioning satisfactorily.

Twenty-seven Nisei were arrested in July, charged with failure to report for preinduction physical examinations, but at their trial at Eureka, Calif., the charges were dismissed when the court held that Selective Service did not apply to residents of Tule Lake, since it was a segregation center. Also in this month 16 men held in the Stockade, where the more belligerent were confined, went on a hunger strike which lasted 10 days.

There followed a period of agitation for "resegregation" by the pro-Japanese group, which began to promote Japanese culture through three societies, Sokuji Kikoku Hoshi Dan, for older men; Hokoku Seinen Dan, for younger men and Hokoku Joshi Dan for women. These societies sponsored early morning marching formations by their members and engaged in other pro-Japanese rituals intended to develop more strongly the Japanese pattern of living. These practices subsided, however, and much of the resegregation agitation also, with removal of 56 of the leaders to the internment camp at Crystal City, Tex.

In December the Department of Justice completed hearings on another 56 men who had asked expatriation, and these, together with 14 aliens, were transferred to the interment camp at Santa Fe, N. Mex. They left Tule Lake on December 28, 10 days after announcement of the lifting of the West coast ban. This announcement and the accompanying announcement of the liquidation of the other centers had a dampening effect on any demonstration by the population. In all, 1,416 persons were removed by the Justice Department from the Tule Lake center to interment camps during the fiscal year.

EMERGENCY REFUGEE SHELTER

On June 30 the Emergency Refugee Shelter at Fort Ontario, Oswego, N. Y., completed its first fiscal year under the administration of the War Relocation Authority, which was first designated for this responsibility on June 9, 1944.

While plans were being made to receive the European refugees as the 1944 fiscal year closed, the War Relocation Authority did not actually assume custody of the Fort Ontario grounds until July 30. Six days later, on August 5, the refugees arrived at the Shelter where housing had been prepared for them on the old fort grounds.

In the group were 982 persons ranging in age from infants to octogenarians, representing 18 nationalities. The largest national groups were 367 from Yugoslavia; 244 from Austria; 149 from Poland; 94 from Germany and 41 from Czechoslovakia. Others were from Belgium, Bulgaria, Danzig, France, Greece, Holland, Hungary, Libya, Rumania, Russia, Spain, and Turkey.

With so many nationalities represented the Administration was faced with complex problems caused by language, geographic and cultural differences. However, a plan of community organization was set up similar to that which had been operating in the relocation centers, with the exception of schools. Arrangements were completed on September 1, with school authorities in the adjacent town of Oswego, whereby the children of the refugees would be accepted on the same basis as American children. With the opening of classes, 189 of these children were enrolled.

Although the refugees were brought into the United States outside mmigration quotas and were required to sign an agreement which ated that they understood they were to return to their homes after e war, it soon became apparent that the majority had no desire to turn, that many had close relatives in the United States, and that ost sections of liberated Europe were in no position to receive them. he most feasible alternative was to develop procedures under which ose who desired to remain in America could be admitted under uotas which had not been filled since the start of the war. arly in the spring the War Relocation Authority began exploring the ossibility of such a program, with the Departments of State and ustice, but no definite conclusions were reached by the end of the scal year. Meanwhile, members of the subcommittee of the House ommittee on Immigration and Naturalization conducted hearings at he Shelter on June 25–27, inclusive, to determine the possibility and dvisability of extending immigration status to the Shelter residents. s the year closed, this subcommittee had not yet announced its indings.

During the year there were 14 permanent departures from the Shelter. One person left on February 28 for the Union of South Africa, and 13 others returned to Europe on the Gripsholm on May 30. There were 10 deaths and 11 births during the year, leaving a net population of 969 as of June 30.

On June 6, the over-all responsibility for the Shelter program was transferred by order of the President from the War Refugee Board to the Department of the Interior.

CONCLUSION

As the War Relocation Authority approached the end of its unique experience in caring for a displaced racial segment of the American population, it becomes somewhat easier to evaluate that experience in proper perspective and to derive from it certain basic recommendations for the future.

First, the War Relocation Authority earnestly hopes that the United States will never again be faced with a similar problem.

Second, the Authority recommends strongly against putting displaced people in camps except for limited periods and under emergency conditions, such as natural catastrophe, where there is no feasible alternative.

Third, this agency has learned the grave dangers that lie in generalizing about a whole group of people and restricting their movements on the basis of such generalization. It believes deeply that no resident of this country should be detained or moved against his will merely because he is a member of some group. All actions of this kind should be based on painstaking examination of the person's individual record.

Fourth, the War Relocation Authority is under no illusions that it has completely solved all problems of the evacuated people of Japanese descent. After the last War Relocation Authority field office is closed, there will still be a tremendous job for American democracy in helping these people to become satisfactorily readjusted and in safeguarding their rights against the poison of racial discrimination. But this is a job which can be done most effectively by private organizations and individuals working close to the problem in the scores of communities where the resettling evacuees have made their homes. For more than 2 years the Authority has been encouraging such groups to assume an increasing measure of responsibility for evacuee adjustment and for protection of evacuee rights. It now looks forward to the termination of its own official life with full confidence that the work of fitting the evacuated people back into the main stream of our natural life will be carried forward with energy and zeal.

Board on Geographical Names

MEREDITH F. BURRILL, *Director*

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In the latter part of the fiscal year 1943 the present Division of Geography which, together with the interdepartmental Advisory Committee constitutes the Board on Geographical Names, was greatly expanded to enable it to formulate quickly policies with regard to geographic nomenclature in areas of actual or potential military operations, and to provide on short notice great quantities of correct geographical names in war theaters. In performing this work the Division has acquired the know-how for dealing with nomenclature problems and has developed techniques for rapidly processing large numbers of names in a given area. This has enabled the Division to edit maps and manuscripts and to check lists involving hundreds of names in a relatively short time. These nomenclature policies going beyond the well-known names that appear on all small scale maps, these techniques for handling large numbers of names, and the acquisition of general experience with geographical names are important facilities which the Division of Geography is in a position to place at the disposal of the agencies concerned.

Great strides in the formulation of policy have been made following clarification of the working relations of the Division of Geography and the interdepartmental Advisory Committee by Departmental Order No. 2002 dated October 26, 1944, and published in the Federal Register for November 1, 1944. The Federal agencies and private geographical societies represented on the Advisory Committee on June 30, 1945, were as follows: Government Printing Office, Library of Congress, State Department, Office of the Chief of Engineers, Military Intelligence Service, Post Office Department, Office of Naval Intelligence, Hydrographic Office, Forest Service, Bureau of the Census, Coast and Geodetic Survey, Geological Survey, National Archives, American Geographical Society of New York, the Geographic Society of Chicago, Geographical Society of Philadelphia, and the National Geographic Society.

The need for readily available source materials to accomplish the work for the armed forces required the acquisition of a map collection of approximately 100,000 maps and a library of 12,000 volumes providing material applicable to the name problem. This is one of the largest general map collections in the United States and it is the only library of any size specializing in place-name materials.

In the course of war work the master card file with the cooperation of the armed services has been built up from 18,745 names to 990,390 names. This file is a facility which is believed to have no counterpart anywhere. In addition to the 33,273 names on which decisions have been rendered, more than three-fourths of the others have been processed according to standard directions, with extensive cross-referencing of variant names. In addition to the master card file a Mongolian word file of 30,000 cards has been compiled to decipher Mongolian names which consist almost entirely of descriptive terms. At the present time there is no comparable English-Mongolian dictionary in existence.

The replacement value of the card files, the name decisions, the map collection, and the library of the Division of Geography is estimated conservatively at $850,000.

The value of the services of the Division of Geography to agencies concerned with place names is commensurate with the extent to which they use it and the completeness with which they rely upon it. Full value and complete consistency with regard to name usage can be gained only by a centralization of work on geographic nomenclature.

With the aid of the name file now at hand the Division of Geography is prepared to handle with a minimum of additional research all normal peacetime requests of Government agencies for names in the theaters of World War II and most such requests for foreign names in other parts of the world.

With the close of hostilities it is planned to apply the techniques, facilities, and experience developed during the war to the backlog of approximately 4,500 domestic name problems which have accumulated while high priority war work postponed their solution. It is further planned to anticipate name problems in areas where large domestic mapping programs are going to be conducted by compiling state or territorial gazetteers for which each name will be processed. Eventually the entire Nation and each of the territories will be covered by such a gazetteer which should reduce to a minimum name problems arising from future mapping programs on a scale of 1:62,500 or smaller.

Office of the Solicitor

FOWLER HARPER, *Solicitor*

STREAMLINING of review and advisory procedures enabled the Solicitor's Office, during the past fiscal year, to devote a major part of its efforts to the legal implementation of departmental programs for peacetime reconversion, while continuing to carry its regular load of normal departmental legal work and the extra load imposed by departmental war activities in fuel, mineral, territorial, and various other fields. Legal programs have been formulated for the broader use of the public domain; the extension and improvement of the Federal range for grazing purposes; the resumption of operations on a peacetime schedule of the vast recreational, scenic and historical facilities of the National Park System and the accommodation of the millions of expected visitors who have been unable to avail themselves of these facilities in recent years because of wartime restrictions to travel; the exploration for and the development of the mineral resources of the country; the completion of the vast reclamation projects interrupted by the war; the social and economic development of the territorial and island possessions; the programs for land utilization in aid of the sound rehabilitation of thousands of returning veterans; the development of public power; the disposal of surplus property; and many others embodied in pending or proposed legislation.

Most of the programs for reconversion have been conceived in legislation presented to the Congress and nearly all are related more or less intimately to activities of the Department. The future of the light metals industry—aluminum and magnesium—was the subject of extensive hearings before a committee of the Senate, at which the Nation's leading industrial and governmental authorities, including Secretary Ickes, and the heads of several affected departmental agencies, testified. The future of this industry is closely interwoven with the Department's interests, especially in the programs of the Geological Survey, the Bureau of Mines, and the several Federal power agencies, and the questions of law involved are manifold.

The pattern for the future is clearly reflected in legislation proposed and sponsored by the Nation's industrial, scientific and military leaders, including proposals for the resurvey of the Nation's mineral reserves as the basis of future control and beneficial use; for the creation of a minerals stock pile for industrial and military requirements; for scientific research and development; for the release to industry generally of scientific knowledge acquired in this war from allied and enemy sources; and for the control of patents developed in whole or in part with Federal funds.

Proposals for postwar scientific research and development which have been presented to the Congress have raised questions of law demanding the most careful consideration, since hardly a bill has been introduced which would not duplicate, supersede, or at least curtail existing activities in this field now authorized to be conducted by Bureaus of the Department. The proposals for the stock piling of strategic materials were and will continue to be major legal and legislative problems of Department-wide concern.

The equitable control of patents developed with the aid of Federal funds and the prevention of the monopolistic exploitation of such patents, is the subject of much concern to both industry and the Congress. The Mines Division of the Solicitor's Office has been engaged in drafting regulations with respect to the granting of licenses and the protection of the Government's interests in departmental patents. Many of these patents, including a recent application for one covering a device to locate ores required in the development and control of atomic energy, are of great importance in the future economy of the Nation.

The bills to create regional authorities affect virtually every activity of the Department, and if enacted doubtless would incorporate many of the functions now performed by several departmental agencies—those of the Bureau of Reclamation would be particularly affected as would also those of the Bureau of Mines, the Geological Survey, the National Park Service, the Grazing Service, the General Land Office, the Fish and Wildlife Service, the power projects and other conservation activities. The preparation of reports for congressional committees considering these measures, the marshalling of facts upon which the Secretary and the heads of the various bureaus could base their testimony before those committees and the questions of law involved required months of legal research, preparation and analysis on the part not only of the Legislative Division of the Solicitor's Office but, also, of the lawyers of the bureaus involved.

As the plans develop for the future the vast amount of legal work which is inevitably bound up in the evolution of the reconversion programs becomes discernible. While the Legislative Division of the Solicitor's Office has been the clearing house for proposals originating in the Congress, or proposed for enactment by the Department, the entire legal staff of the Department necessarily has participated to the extent that plans affected a particular agency and its normal, peacetime functions.

SOLID FUELS ADMINISTRATION FOR WAR

The Legal Division of the Solid Fuels Administration for War drafted regulations and orders embodying the Administration's program for the distribution of limited supplies of bituminous coal, anthracite and other solid fuels. It prepared interpretations of provisions of the regulations and drafted exceptions and directions necessitated by constantly changing conditions in solid fuels' production and consumption. It continued to supervise the organization and functioning of industry advisory groups, and also handled all legal problems in connection with compliance proceedings brought to enforce regulations, and cooperated with the Department of Justice in criminal prosecutions. Following liquidation of the Coal Mines Administration in September 1944, and the transfer of the functions of that agency to the Solid Fuels Administration for War, the Division drafted the documents incident to the seizure and possession of struck coal mines by the Secretary under various Executive orders.

WAR RELOCATION AUTHORITY

On December 18, 1944, the United States Supreme Court announced two decisions of major significance to the program of the War Relocation Authority. They were *Korematsu* v. *United States*, 323 United States 214 (October 1944), in which the court upheld the constitutionality of the original Army orders excluding all persons of Japanese ancestry from west coast military areas, and *Ex parte Mitsuye Endo*, 323 United States 283 (October, 1944), in which the court held invalid the detention of an American citizen of Japanese ancestry conceded to be loyal to the United States. These decisions preceded by 1 day a revocation of the Army's mass exclusion orders and the institution by the Army of a plan for excluding individually from west coast military areas persons regarded as dangerous to the national security. Following these developments, the Solicitor's Office participated in the development and institution of a program designed to effect an orderly return of all eligible relocation center residents to normal communities and the prompt liquidation of the relocation centers, including the handling of legal problems relating to relocation center management, evacuee property management and disposal, and the rehabilitation of relocated evacuees.

GENERAL LAND OFFICE

The Law Division of the General Land Office handled more than 35,000 matters during the fiscal year, including assistance to the Department of Justice in the preparation of litigation; the rendering of legal opinions on a variety of subjects; claims relating to the public domain; the preparation of proposed legislation and reports on pending bills; the drafting of regulations affecting the public domain and certain hearing procedures; and assistance rendered to congressional committees on proposed surplus property legislation and on various questions with respect to the administration of minerals in the public lands, particularly those relating to the leasing of potassium resources, the legality of withdrawals of public lands made by the Secretary of the Interior, and the purpose and effect of the potassium leasing regulations of January 4, 1945.

GRAZING SERVICE

The Office of the Chief Counsel of the Grazing Service continued to handle an increasing volume of work, including the interpretation of statutes, rules and regulations, and orders affecting the administration of the Federal range; the preparation of contracts and cooperative agreements with individuals, livestock associations, State cooperative grazing districts, and Federal and State agencies; the drafting of proposed rules and regulations, instructions and forms necessary to administer the Taylor Grazing Act; the codifying of rules and regulations for publication in the Federal Register; and many other related subjects.

BUREAU OF RECLAMATION

During the past year, apart from the time devoted to wartime activities, the attorneys of the Bureau of Reclamation, both in the Office of the General Counsel in Washington and in the field, have been engaged in the formulation of plans and the preparation and revision of contracts looking toward a return of the Bureau to its peacetime role and the early resumption of irrigation and other construction projects suspended during the war in accordance with War Production Board regulations. Part of a series of 37 basin reports, to be submitted to the Congress, providing postwar plans for the comprehensive development of the water, land, and hydroelectric power resources of the major basins of the West, are receiving legal review as of the writing of this report. Contracts were drafted involving the disposal of metropolitan water district unused electric energy, heretofore sold to Defense Plant Corporation for use in its magnesium plant, to the city of Los Angeles, Southern California Edison Co., and the California Electric Power Co. Negotiation of repayment contracts with the three irrigation districts of the Columbia Basin project, Central Valley project studies, the organization of three Montana irrigation districts, the treaty between the United States and the United Mexican States relating to the utilization of the waters of the Colorado, Tijuana, and Rio Grande Rivers, and numerous other intricate legal problems involving the multiple-purpose projects of the Bureau, demanded the attention of the Legal Division. Bureau attorneys conducted or participated in a variety of court cases arising in connection with Federal reclamation. After years of litigation, the United States Supreme Court on June 11, 1945, finally handed down an opinion in the best known and perhaps the most important case, *Nebraska* v. *Wyoming and Colorado, United States, Intervener,* defining the scope of State and Federal authority in interstate streams.

GEOLOGICAL SURVEY

The Office of the Chief Counsel, Geological Survey, has furnished the legal implementations of the bureau's program in the search for and utilization of the Nation's mineral resources. It participated in the negotiation of 22 new unit agreements embracing 198,408 acres providing for immediate exploration and development of wildcat areas for oil and gas—to discover new oil reserves to replace dwindling known reserves. Seven communitization agreements were approved for the pooling or consolidation of Federal and non-Federal lands required under regulations of the Petroleum Administrator for War as a condition prerequisite to the use of material in drilling wells—a program designed to conserve vital materials without impeding maximum production. An agreement between the Navy and Interior Departments was consummated with respect to the supervision of the lands embraced within the Naval Petroleum Reserves.

An important victory was won in the case of *United States* v. *General Petroleum Corporation, et al.*, involving additional royalties claimed to be due the United States from the holders of Federal oil and gas leases in the Kettleman Hills oil and gas field, California. The United States District Court held that the Secretary of the Interior has the power, under the Mineral Leasing Act of February 25, 1920, to determine the value of oil, natural gas, and natural-gas gasoline, or any of them, which ruling, if it becomes final, will result in the recovery of additional royalties estimated roughly at $1,500,000. The Chief Counsel's Office engaged in the defense of the case of *The Ohio Oil Company* v. *United States,* brought to recover oil and gas royalties alleged to have been wrongfully exacted by the Secretary of the Interior and, although this suit involves only $10,000, the decision will affect other royalties paid to the United States amounting approximately to $250,000.

NATIONAL PARK SERVICE

The Office of the Chief Counsel, National Park Service, during the fiscal year handled a large volume of matters involving jurisdiction with respect to hunting, disposal and control of wildlife, and the regulatory powers of the Federal Government over mineral locations and non-Federal lands, in areas administered by the National Park Service, questions with respect to the use of park roads, Federal and

State jurisdiction over parkway crossings, and the Service's authority as to public water reserves and power licenses in national park and monument areas. There were also many legal matters inherent in Service administration, such as water rights, land acquisition, wartime use of areas, drafting and reviewing permits and contracts, preparation of legislation, and assistance rendered the Department of Justice in the Jackson Hole National Monument case of *Wyoming* v. *Franke*, in which the authority of the Federal Government in establishing the Jackson Hole Monument was upheld by the court in a decision of February 10, 1945. The office had the responsibility for the preparation of the National Park Service law book supplement, as well as the compilation of proclamations, and orders relating to areas in the national park system. The Service's postwar programs of major importance in planning, construction and land acquisition, also required constant legal consideration and counsel.

FISH AND WILDLIFE SERVICE

Participation by the Fish and Wildlife Service, in international fisheries problems became intensified during the year and brought out many questions for consideration by the chief counsel, both in frequent interdepartmental discussions and in the drafting of proposed agreements and legislation. At the same time, studies of the effects on the development and conservation of the wildlife and fishery resources of the numerous proposed irrigation and flood-control projects raised a variety of legal and legislative questions. Proposed legislation relating to the control of pollution and to other specific phases of wildlife conservation affecting long-time programs required the preparation of numerous reports. Of interest were the problems involved in negotiating for the transfer to the government of state lands lying in the Everglades section of the State of Florida. In anticipation of intensified hunting during the 1945–46 season, certain provisions of the migratory waterfowl regulations were revised with a view to offsetting any marked decrease in the waterfowl population.

DIVISION OF TERRITORIES

Implementing the departmental program of increased home rule in the territories, the Office of the Chief Counsel, Division of Territories, in cooperation with the Solicitor's Office, drafted a series of bills for introduction in the Congress and in the territorial legislature. Among the bills so drafted and enacted during the past fiscal year were bills outlawing racial discrimination in Alaska, and providing for a referendum on Alaskan statehood. Conferences with territorial officials and with the War Department culminated in military and presidential proclamations terminating martial rule in Hawaii. The legal staff of the Division of Territories assisted the Department of Justice in several important cases involving the interests of the Department and the local governments; numerous legal memoranda and opinions with respect to controversial questions were prepared; Executive orders authorizing a variety of activities; and much time was devoted in acting as liaison between the territories and other departments of the Federal Government. The counsel-at-large for Alaska continued to represent the Solicitor and to protect the interests of the Federal Government in the resources of the Territory, handling a most diversified variety of problems affecting property and individual rights.

LEGISLATIVE DIVISION

The variety and volume of matters passing through the Legislative Division continued to increase. Legislation introduced, including reports to committees, the Bureau of the Budget and related correspondence, involved 2,698 items; proposed legislation by the Department, 377 items; legislation proposed by other Departments, 104 items; bills introduced of interest to the Department, 738 items; laws enacted affecting the Department, 101 items. In addition the Division covered all pertinent congressional committee hearings and submitted reports where necessary; prepared or reviewed statements to be made by officials before committees; and participated in all sessions of the Departmental Legislative Committee.

PUBLIC LANDS DIVISION

A substantial part of the work of the Public Lands Division involved questions arising in the administration of the Mineral Leasing Act, particularly with reference to oil and gas matters. Considerable time was devoted to cooperation with a committee from the oil industry in considering suggestions for amendments to the act. The possibility of augmenting the Nation's future oil supply from deposits in submerged coastal lands below low tide and the propriety of Federal administration of these reserves also engaged much attention. An original Supreme Court proceeding to determine title to the mineral rights in these lands is being urged as the appropriate method of settling this question. With the aid of the Division in preparing appropriate regulations and a form of cooperative agreement, an outstandingly important program for sustained timber yield, the first of its kind, was put into effect for the revested Oregon and California railroad lands, reconveyed Coos Bay Wagon Road lands and intermingled State, county, and privately owned timberlands. The Department's policy of conserving isolated tracts for their most economic use, including possible inclusion in Federal, State, or local projects, was clarified and public sales of such tracts approved only after careful consideration. Effective progress was also made in an effort to eliminate foreign control of valuable public land deposits of sodium borates and various forms of potassium as minerals vital to our national economy. The Division actively conducted litigation seeking to preserve title in the United States to rich sodium borate lands and railroad grant lands and to sustain administrative practice under the Mineral Leasing Act.

CONSERVATION DIVISION

Matters of outstanding interest handled by the Conversation Division during the fiscal year were original opinions with respect to the excess-land provisions of the reclamation laws; the application of Canada-United States trade agreements to action proposed under amended salmon fishery orders; the acreage limitations on grazing districts under the Taylor Grazing Act; power rate schedules, interest requirements, repayment periods, and minimum revenue requirements for power generated and sold from the Columbia Basin (Grand Coulee) power project; advice to the Governors of Puerto Rico and Alaska as to the extent of their authorty in certain matters; questions concerning the liquidation of prewar debts in Japanese currency during Japanese occupation of Manila; and questions of Philippine Constitutional law growing out of the reoccupation of the Islands by the American Forces.

In addition to the usual volume of inquiries involving all phases of personnel and fiscal law, new questions arose with respect to the application of the war overtime pay statutes; the assignment of Federal personnel for duty in foreign countries; the acceptance of foreign-national trainees for assignment within the Department under the Government's over-all cultural-cooperation program; emergency employment of aliens, and the effect of the President's order of June 6, 1945, transferring to the Secretary of the Interior over-all responsibility for the Emergency Refugee Shelter at Oswego, N. Y. The Division continued to render opinions on questions submitted from all bureaus of the Department on matters affecting delegation of authority, damage claims, and administrative findings on appeals from contracting officers' findings of fact, as well as contract matters generally. Of particular interest in connection with the latter was the termination of a contract with private contractors for the construction of an oil refinery in foreign territory, and the negotiation and settlement of a claim by the Department against the operator of the Department's cafeteria.

MINES DIVISION

The Mines Division continued to serve in the dual capacity as a branch of the Solicitor's Office and as counsel for the Bureau of Mines. Among the important services performed has been the work involving patents. Some 67 new inventions have been processed for the Deırtment and 9 for the Synthetic Liquid Fuels Division; 35 Solicitor's ›inions have been written concerning the rights of inventors, and 15 ıtents have been secured through the services of the Department of ıstice, 10 of these are assigned outright to the Government. There :e pending in the Patent Office approximately 120 patent applica- ons. An amendment to the departmental patent regulations and a ew set of regulations governing the granting of licenses under patent ghts, if adopted, will centralize the licensing system, protect the)epartment's interests in inventions and make possible control over ıformation concerning the state of the Department's title to patents.

The Division advised in the establishment of the synthetic liquid ıels program; 31 contracts were processed, 9 inventions studied and pplications are going forward to the Patent Office. It is anticipated hat this work will assume greater importance as the synthetic liquid uels program develops. The work of explosives control increased ıaterially; 35 license revocation proceedings were prosecuted. A bill o continue the safety features of wartime explosives control has been lrafted and submitted to the industry for discussion.

During the year approximately 200 contracts were reviewed, lrafted, redrafted or approved, including approximately 60 for exploratory drilling, 33 for supplies, 25 for cooperative ventures, 35 for ırchitects, engineers, and construction, 10 for mining operations, and ›ther miscellaneous matters including helium.

The Division directed a cooperative in-service training program for attorneys of the Interior Department and 14 cooperating agencies.

PROPERTY ACQUISITION DIVISION

The Property Acquisition Division participated in the preparation of contracts for the purchase of properties and performed the legal work in connection with land acquisitions required for the helium program, synthetic liquid fuels program, and mineral exploration programs of the Bureau of Mines for war and postwar use. It reviewed abstracts of title to more than 237 separate parcels involving over 211,650 acres of land acquired by the Government under the Forest Exchange and the Taylor Grazing Act, and also approved title to thousands of acres of donated land accepted by the Government for national parks. The consolidation of Indian land holdings into usable economic units and the acquisition of homes for Indians also involved considerable detailed legal work.

INDIAN DIVISION

The work of the attorneys of the Indian Division of the Solicitor's Office in cooperation with Bureau lawyers has been directed in great measure toward the fulfillment of long standing treaty and other obligations of the Government to the Indians. A final settlement with the State of Wisconsin brings to a close a 91 years' controversy over the title to certain lands located within the boundaries of the Menominee Indian Reservation and effectually restores them to the Indian reservation. Hearings were held in Alaska to determine native fishing and other occupancy rights which have been matters of controversy for many years. Assistance was rendered to the House Committee on Indian Affairs in preparing an Indian claims bill which would attempt to settle, once and for all, any and all claims of Indians against the United States. The Department's position in the protection of Indian land titles was sustained in the case of *United States* v. *Drummond*, 324 U. S. 316, involving the interpretation of highly complicated laws pertaining to Osage Indians in Oklahoma; the court also ruled the United States to be a necessary party to actions in State courts in order that it be bound in Indian cases. The Division also participated in the preparation and presentation of other important cases including *Anglin & Stevenson*, 145 F. (2d) 622, holding that the Federal court could determine an award of attorney fees out of the restricted estate of a deceased member of the Five Civilized Tribes in a suit involving the quieting of title and determination of heirs; *United States* v. *Board of Commissioners of Fremont County*, 145 F. (2d) 329, holding that lands purchased with funds of an Indian tribe, conveyed to United States in trust for the tribe, are not subject to State taxation; *House* v. *United States*, 144 F. (2d) 555, 65 Sup. Ct. 270, upholding the right of the United States to maintain a suit for accounting of funds of a full-blood Indian of the Five Civilized Tribes released by the Superintendent without authority of law; *Board of Commissioners of Osage County* v. *United States*, 145 F. (2d) 1022, affirming the decision of the lower court that the act of June 20, 1936 (49 Stat. 1542), as amended, exempting certain Indian-owned lands from taxation, applied to Osage Indians, and that designation of the homestead as provided in the act is not a condition precedent to the tax exemption granted by the act where the Indian owns more than 160 acres of purchased land; and *County of Thurston Nebraska* v. *United States*, 149 F. (2d) 485, upholding the constitutionality of the tax exemption acts of June 20, 1936 (49 Stat. 1542), May 19, 1937 (50 Stat. 188), as applied to lands purchased by Indians in the State of Nebraska.

Legislation affecting the restricted lands of Indians of the Five Civilized Tribes was introduced in the present Congress looking to the quieting of titles affected by the decisions of the Federal courts in the cases of *United States* v. *Hellard*, 322 U. S. 363; *Murray* v. *Ned*, 135 F. (2d) 407, and *Williams* v. *United States*, 139 F. (2d) 83. The departmental reports to the congressional committees were prepared in this Division and several amendments suggested therein were adopted by the Congress. Act of July 2, 1945 (Public Law 116, 79th ong., 1st sess.). A bill (H. R. 2294) was introduced during the year hich if enacted would provide a uniform code of descent of restricted ndian lands. Legislation establishing a new technique in securing epayment of construction charges on Indian irrigation projects was avored by the Division. Act of July 14, 1945 (Public Law 149, 79th ong., 1st sess.).

The work of the Indian Division during the year relating to war ctivities involved the giving of legal advice and the review of corespondence, leases, permits and other agreements looking to the iscovery and development of strategic minerals and the utilization f Indian and public lands for military purposes and increased food roduction. Several hundred thousand acres of virgin land in Wyming, Montana and other States were placed under geological and eophysical prospecting permits during the year.

Division of Information

JOHN E. RYCKMAN, *Director*

* * *

DURING most of the 1945 fiscal year the Division of Information was still occupied largely with keeping the public acquainted with the Department's single-minded efforts to supply the essentials of war unstintingly from the Nation's natural resources. Before the year's end, however, with the collapse of the Nazi regime and with unmistakable signs of a similar denouement in the Pacific, the Division began to prepare for a shift of emphasis from the profligate expenditure of nature's treasures to the Department's traditional policy of conservation.

Just as foresight had prepared the Department for an immediate shift to a war basis before nightfall on Pearl Harbor Day, plans had been in the making for more than a year against the possibility of an immediate peace.

Thus, while still conforming to Office of War Information and other wartime security regulations in the handling of such informational programs as the Solid Fuels Administration for War, in exercising judicious restraint in disseminating information regarding the important war-related work of the Bureau of Mines, the Geological Survey and other agencies, the Division was getting ready to resume its peacetime activities that so long had lain dormant.

For example, the Division originated and prepared a comprehensive series of articles dealing with the Department's plan to proceed with postwar construction and conservation programs designed to give employment to veterans equivalent to 1,500,000 man-years of work over the first 10 postwar years. This material was published, with appropriate illustrations, in whole or in part by at least a score of nationally circulated magazines.

Before the end of the year the Division also was responsible for writing and publishing a pamphlet entitled "Our Last Land Frontiers," designed as a guide to veterans in their desires to settle on public lands both in continental United States and Alaska. This booklet proved to be one of the most popular ever issued by the Department with 20,000 copies being distributed by the Department alone, and many other thousands through veterans' organizations, and through separation centers of the armed forces.

In addition to the booklet, the Division prepared a synopsis in popular form which was published by several national syndicates serving several thousand daily and weekly newspapers and by a dozen or more nationally circulated magazines.

These are merely examples of the directional work of the Division designed to integrate the informational programs of the Department's various bureaus and offices having to do with the development and wise use of such natural assets of the Nation as metals, power, fuel, helium, food, land, timber, and fisheries.

In other words, the Division continued to function as the directing and coordinating office of the Department through which all informational material is channeled from the bureaus to the public. This applies not only to day-to-day press releases of general circulation but also to books and pamphlets prepared by the Bureaus on specialized subjects, over which general printing supervision is exercised by the Publications Section.

The Division was also responsible for the editing, designing the format and supervision of the printing of the Secretary's annual report, as well as for the publication of Inside Interior, a monthly newspaper intended to keep the Department's own employees abreast of its activities.

There were no appreciable changes in the organization set-up of the Division, consisting of the Director's office, Radio, Publications, and Photographic Sections, although some changes in assignment of duties have been effected as changing conditions required.

RADIO SECTION

Throughout the year the Radio Section, operating the only modern broadcasting and recording studios in the Government, continued its intensified war service to most war-engaged Federal agencies, under the general supervision of the Director of Information.

Extensive and almost constant use was made of the studio's facilities by the Office of Strategic Services and by the Army and Navy in the preparation of secret programs having to do with psychological warfare. Special training programs were recorded for use in every theater of operation, and, toward the end of the fiscal year, recordings were already begun for use in demobilization work on ships and in Army centers of concentration.

Numerous live programs, as well as recordings, were prepared and broadcast through these facilities for overseas use by the Office of War Information and other agencies affiliated with it. In this work as many as 29 different foreign languages were used.

In addition, special programs, spot announcements, and other material for broadcast were produced for such departmental agencies s the Solid Fuels Administration for War and the War Relocation authority.

One of the outstanding jobs performed by the Radio Section was the complete production of a series of six 15-minute recordings entitled "This Is Puerto Rico," prepared under the auspices of the insular Government of Puerto Rico. This series, an educational and documentary feature, was designed for use in more than 2,500 high schools of the country to acquaint the rising generation with this American outpost in the Caribbean.

PUBLICATIONS SECTION

The enlarged functions, begun last year, by which the Publications Section is made responsible not only for the procurement of printing but also for editorial content and format of bureau publications, have been continued with obvious success.

Not only have important economies been effected by centering in this section the power to reject faulty or undesirable manuscripts, but better design and more attractive publications have resulted. There is still much to be done in presenting to the public a better-rounded set of publications on the Department's activities. But a good start has been made and further improvements will be accomplished as the Department gets into its stride of peacetime work.

PHOTOGRAPHIC SECTION

While the major portion of the Photographic Section's efforts were devoted to furnishing photographs and other illustrations to Department agencies directly concerned with the war, it also began preparations for enlarged activities in anticipation of peace.

Toward the end of the year, for example, the Division compiled and published a listing of about 1,000 background photographs selected from many thousands of negatives in the Department's photographic files. The list of selected photographs, depicting historic landmarks and other subjects of permanent interest to students of the Nation's natural resources, was furnished to editors of important newspapers, magazines, and photographic syndicates as a backlog of available illustrative material upon which they are privileged to draw in connection with stories or articles dealing with any of a large number of subjects within the Department's purview.

During the year the Division also inaugurated a fortnightly News Picture Service, by means of which photographs of current interest are distributed to about a score of news picture syndicates, illustrated feature services, magazines, and newspapers. Thus, the Department, with comparatively little public expense, is able to enlarge a thousandfold its effectiveness in acquainting the public with its varied activities. This service has proved so popular throughout the country that, with the coming of peace, it is contemplated that the Division of Information will be called upon to make it a weekly instead of a fortnightly feature.

These activities of the Photographic Section, while increasingly important, are still virtually incidental to the regular volume of work that it has been called upon to perform. Its principal work, from the standpoint of volume, has continued to consist of furnishing illustrative material for bureau publications, progress reports to Congress and the like, as well as meeting a constant demand for material to illustrate textbooks, guidebooks, pamphlets, and travel literature requested by scientific, trade, and other magazines and publishing organizations.

Division of Personnel and Management

Mrs. J. ATWOOD MAULDING, ***Director***

* * *

WITH the war continuing throughout another year our immediate problem has been the securing of personnel sufficient in number and quality to meet the war needs. Recruitment has been difficult, especially to meet the continuing demands of the Geological Survey and the Bureau of Mines for geologists, engineers, metallurgists, and other specialized personnel, which has made it necessary to ask for occupational deferments from the military service for some in these groups. Recruitment has also been especially difficult for stenographic and typist positions where the Civil Service Commission has been able to supply few eligibles, and replacements have been dependent upon applicants found by the Department. Special effort has been made to fill as many positions as possible with women, and with men not eligible for military duty. At present fewer than 15 percent of our permanent employees are subject to military service. More women are employed in the Department than ever before, the latest figure being 10,676.

More than 7,500 Interior Department men and women have gone into the armed forces; approximately 500 have been discharged and returned to work. These employees were either placed in their old jobs with no loss of seniority rights or were given higher-grade assignments. One hundred and three of our employees have died in the war and eighteen are missing.

While the number with specialized training and experience deferred from military service is slightly higher than a year ago, this is accounted for by the more liberal policy of the Selective Service System for deferring men over 30 and the necessity for making deferment requests for those found physically unfit for combat. The increase, however, has all been in the older age groups as the number of deferments for those below 30 has been drastically reduced.

The Department continues to fill positions above the entrance grades by promotion from within so far as qualified candidates are available. As part of the program to increase the productive capacity of Interior employees, the Training Section conducted across bureau lines during the year refresher courses in typewriting and shorthand, personnel administration, secretarial training, and efficiency ratings, as well as orientation classes for new employees. The Department assigned two employees this year to the administrative internship program of the Civil Service Commission.

The Classification Office has allocated approximately 7,811 positions during the year and has made numerous surveys of groups of positions in the field. One of the important accomplishments of the Office has been the establishment of a Standards and Specifications Section to assist in preparing and publishing standards for the allocation of field positions under the Classification Act, which was directed by Executive Order 9512. This will be to a large extent a continuation of studies already started to establish standards for typical positions in the field services of the Department.

On September 8, 1944, the basic policy governing wage-fixing for employees not within the purview of the Classification Act was fixed by Secretarial order. On March 30, 1945, detailed regulations and procedures were issued by the Director of Personnel. In these regulations the procedure fixing rates of pay for ungraded employees by wage boards, which had been followed previously in several bureaus, was extended as a uniform method throughout the Department.

Morale in the Department is high despite the abnormal conditions of war. The number of grievances, disciplinary actions, and appeals of efficiency ratings have continued to run small.

Services to employees relating to group insurance, hospitalization, health, credit, loans, and counseling have been maintained, and with respect to counseling have been implemented further. The recreation program established under the guidance of the employee counseling service is felt to be of inestimable importance as a means of communication between employee counselors, personnel officers, and others interested in employee relations in the Department.

While meeting the immediate war demands, we have tried to strengthen the whole personnel structure of the Department for better administration and postwar expansion. We are proceeding with the program of decentalization, looking to the acceptance of more responsibility by the operating bureaus, the Division being concerned mainly with the formulation of good policies and the maintenance of sound personnel standards. In line with this objective, the Office of the Deputy Director of Personnel in Chicago was discontinued in January 1945, and a delegation of considerable appointing authority was made by the Secretary to the three bureaus headquartered there.

The Division is also gearing itself to the veteran placement problem. As one important step, a veterans placement unit has been established to insure that veterans are apprised of and receive their full rights, and that the Department is able to take advantage of new nowledges and skills which they may have acquired while in the ervice.

A personnel conference was held the week of June 4, in Washington, ringing together the personnel officers of all of the bureaus, including ose in the field, for a review of policies and programs and for a ook ahead to the reconversion period.

At the close of the fiscal year the Department had 44,453 comensated employees, 4,686 in the Washington metropolitan area, nd 39,767 in the field; in addition, there were 1,546 uncompensated ersonnel.

Interior Department Museum

H. L. RAUL, *Museum Curator*

* * *

THE Interior Department Museum maintains constant and direct contact with the public, through its modern visual educational techniques. It is an efficient instrument to visualize the manifold functions of the Department. More than 100 display cases exhibit material of great historic and scientific interest. They reflect the history, aims, and current activities of the Department, from its beginning, almost a century ago, to the present. Some of them refer to the Department's contributions toward victory.

ATTENDANCE AND FOREIGN VISITORS

During the past year approximately 46,000 persons visited the museum. The Visitors' Register records visitors from every State in the Union with the exception of Delaware. Registrations were received also from Alaska, Hawaii, Philippine Islands, and Puerto Rico. Many visitors from foreign countries also have demonstrated interest in the activities of the Department as illustrated in the museum, and registrations were received from Barbados, Bermuda, Brazil, Canada, China, Colombia, Czechoslovakia, Dominican Republic, England, France, Haiti, Honduras, Italy, Malaya, Mexico, New Zealand, Poland, and Romania.

COLLABORATION WITH BUREAUS

With the assistance of the Bureau of Reclamation, five display cases were completely revised and new material designed to illustrate the double use of water for irrigation and power production, and for war, domestic, and industrial uses. Featured also are methods of flood control, improved navigation, wildlife refuges, and recreational opportunities. Among the revised displays are colorful representations of Central Valley project and building Grand Coulee Dam. One of the recent additions is a new scale model of a modern, 80-acre irrigated farm, showing how water is brought from Reclamation reservoirs to operate an irrigated farm on a year-round basis, and electric fences which separate rotation pastures.

An engraved brass bar, 3 feet in length, designated as the Standard Yard, is exhibited in the General Land Office gallery. This is the original standard which was sent to the Territory of Nevada by the Office of United States Weights and Measures, in June 1861, for the purpose of establishing and checking standard measurements. It was formerly used by the Office of the Surveyor General to check surveyors' chains in surveying the public land. Three large silhouettes entitled "Steamboat and Canal Days," "The Roundup," and "The Sheepherder," totaling 22 feet in length, designed and completed in the museum, were installed in niches over related display cases in the General Land Office gallery. These complete the series of seven historical subjects portrayed by silhouette in this gallery.

A panoramic pictorial enlargement, approximately 12 feet long, portraying the Wyoming Elk Herd, is a new display in the Fish and Wildlife gallery.

In collaboration with the Geological Survey, new material for three display cases and three large wall niches are in preparation.

A large photo-mural, in full color, illustrates the numerous outdoor activities and recreational facilities provided by the National Park Service for residents of the District of Columbia and neighboring communities. This is particularly interesting during the present period of wartime travel restrictions.

Among the special exhibits is a photostat copy of a chart of the northern portion of Luzon Strait, Philippine Islands, which was seized from the Japanese in the Central Pacific, and insignia taken from members of the Nazi armed forces.

COOPERATION WITH OTHER AGENCIES

During the past year the museum has served many organizations, including the San Joaquin Pioneer Museum and the Haggin Memorial Art Galleries of Stockton, Calif.; American and Canadian Sportsmen's Show, Cleveland, Ohio; University of Oregon; State Department; War Department; Navy Department (Office of Naval Records and Library, Taylor Model Basin, and Bureau of Ships). The majority of these services concerned modern display methods, scale model, and diorama techniques. Services in connection with training methods and materials used in visual education and in veterans' rehabilitation programs were rendered to the American Red Cross; Walter Reed General Hospital; and the Disabled Veterans Educational and Reconditioning Service of the Newton D. Baker General Hospital, Martinsburg, W. Va.

Suggestions were outlined in last year's annual report for possible use of the museum's facilities for postwar rehabilitation work, particularly for returning veterans who were on military furlough from this Department.

LOAN EXHIBITS AND ACCESSIONS

Last October the museum accepted, for an indefinite period, a life-size bust of Thomas Ewing, first Secretary of the Interior, who served from 1849–50. It was loaned to the museum by Mr. Sherman Ewing, a representative of the Thomas Ewing estate. A marble pedestal and bronze inscription plate are also included in this loan exhibit.

A collection of 13 Indian rugs, blankets, saddle blankets, and a dance drum, selected from the Gibson collection, is displayed as a temporary loan exhibit in the radio studio of this Department.

The museum's book collection has been augmented by "Expressions and Impressions," the autobiography of the late A. A. Anderson, which contains many references to early days in the Yellowstone region. This book was presented by the author's daughter, Dr. Eleanor A. Campbell.

SCHOOL CLASSES

In cooperation with various teacher groups and school organizations, the museum has assisted in planning courses in conservation and other activities represented by the Department. Included in these organizations were the Office of Visual Education of the Providence, R. I., Public Schools, and the Fairfax County, Va., Public School System. The museum's special exhibit of strategic minerals has been duplicated, at private expense, for circulation among the schools of Fairfax County, The Virginia Academy of Sciences, and other similar institutions.

ORIENTATION PROGRAMS

During the year the museum added two important services to established governmental employee relations activities. The departmental orientation program for all new employees, managed by the Training Section, Division of Personnel Supervision and Management, was expanded to include explanatory tours of the museum. The administrative intern program, sponsored by the United States Civil Service Commission to promote the development of junior administrative personnel, also included the explanatory tour service in its course of instruction. These students of government administration represented more than 13 agencies.

Conducted tours were given throughout the year to school classes and many other organizations. In some instances unusually large groups attended. For example, the evening tour of 150 persons from the United States Signal Corps, and the Baptist women's organization group of 500 members.

Inquiries were handled daily at the information desk and special services rendered whenever requested. The museum is attractive to the public and of service to the Department. The assistance extended by the officers of the Department and the cooperation given by the bureaus is gratefully acknowledged.

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Natural Resource Problems

ANNUAL REPORT
OF THE SECRETARY OF THE INTERIOR

1946

Annual Report

of the SECRETARY OF THE INTERIOR

Fiscal Year Ended June 30, 1946

UNITED STATES
DEPARTMENT OF THE
INTERIOR

J. A. KRUG
Secretary

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THE SECRETARY OF THE INTERIOR
WASHINGTON

My Dear Mr. President: I transmit herewith the annual report of the Department of the Interior for the fiscal year which ended June 30, 1946.

This report highlights some of the problems of natural resource management and development which face the United States. Some of these problems require immediate action; others must be met in the next few years; still others are of long-range significance both to the national economy and to the national security. All of them are responsibilities of the Department of the Interior upon which we have thought and worked during the past fiscal year.

Sincerely yours,

J A Krug

Secretary of the Interior.

The President,
The White House.

PART I

NATURAL RESOURCE PROBLEMS

OUR PROBLEMS AND PROGRAMS

The past year has been one of transition from war use to peacetime conservation. Our needs have gone from war materials to peaceful requirements. We have been short in many fields. The over capacity of plant that we had before the war saw us through several critical parts of that war. Where we were underdeveloped the Government had to invest billions in a hurry. Now we are moving to a very high level of national income. We are going to need more plant for many types of production. We are going to need more national plant for our resource development. In many western areas progress is being definitely held up at present through lack of reclamation land and water, and through power shortages. The expanding future is blocked by shortages in national plant as well as other lacks.

There have been a few national emergencies in the basic resource field, which covers land, forests, fish, water, parks, minerals, heat and energy. Coal strikes crippled production but did not waste our heat and energy resources, although they raised their price, and gave some urgency to alternative supplies which may in many years include atomic energy. The marginal metal mines presented a conservation problem which has been temporarily taken care of by the stockpiling act which provides for a continuation of wartime aid to them. The stripper oil wells presented a very similar problem of potential permanent loss of a valuable resource. The problem has similarly been covered by the Congress.

We do foresee several dangers to the national resource interest. First, our past neglect to take positive action to put our privately owned forests on a sustained yield basis, plus the enormous wartime demand, threatens an invasion and over-cutting of all our national forests, including that part which is under the Department of the Interior. We feel that would be compounding the past mistakes. We propose to fight against over-cutting on the public domain, for sustained yield operation of private forests and for more national and more private forests.

A second danger lies in the threat to neglect and thereafter to parcel out the rest of the public domain to private interests. We see that threat as an end to opportunity for the many, which has been the basis of our public domain policy and our homestead policy. Much of our public domain and many of our watersheds cross State lines. Great erosion control and reseeding jobs need to be done on them if the people are to keep on getting the meat they want to eat. A strong and continuing policy is needed to prevent overgrazing and land destruction, and it must be an interstate policy. It must be a policy that is large and broad enough to consider the Nation's future rather than the funds available in any State treasury at any time. It must be a policy that recognizes the essential thriftlessness of spending billions on dams while we let the watersheds above them be ruined.

A third danger lies in the threats that the benefits of public investment in resource plant will be grabbed by a few people, and that the door of opportunity will be slammed in the faces of the many who now stand in front of it, waiting. It has been legislative policy for many years to get the electric power benefits from our great dams to the people. It has not been the policy of the Congress to button them up and turn them over to a few power companies at the dams. Yet some private utilities have fought, with some success, against the national legislative policy. We look upon these moves as repealers of the basic principle that public investment should produce the maximum of benefit for the greatest number of people. We see them as hampering the mineral and industrial development of the new regions by preventing industries from getting their energy at the lowest possible cost.

Another part of this same threat is the attempt to close the gates of opportunity resulting from public investment in the face of the veterans seeking land. The reclamation laws since the days of Theodore Roosevelt have held that water should go to build small family sized farms. That usually means that only 160 acres under one ownership can be furnished water. That is enough irrigated land to furnish a solid base for farming success and prosperity. In community property States such as California it means 320 acres where a man and his wife each own 160 acres. Yet large land companies and their adherents are trying to tear down that law for their own benefit and to the disadvantage of literally tens of thousands of veterans, farmers' sons, who are asking for an oportunity to buy land that has adequate water.

This is a problem of no small import to the Nation. We have found that small land ownerships create communities we can be proud of, and large land ownerships, which often make more money per acre, create settlements that are no solid foundation for health, local prosperity, education, or citizenship. If we are to junk 44 years of major national resource policy, we believe it should be done openly and after full public discussion.

The problems connected with utilizing Government resources and public investment to provide opportunity for free but also competitive enterprise does not stop at the basic resource level. During the war the Department early saw the need for more aluminum production, encouraged new enterprises to enter the field and helped persuade the war agencies to invest in new aluminum reduction plants, and also in processing plants that could utilize the lower grade American bauxite. It believed that fuller utilization of this resource was necessary, and that competition would extend the use. Both convictions have proved to be correct. The Nation's aluminum plant is now many times that of the prewar period. The aluminum that went into bombers is now going into housing (taking some of the pressure off our over-cut forests) and many other uses. A large part of the energy produced at the Bonneville and Coulee Dams is being frozen in this form.

But the problem of retaining the competitive companies in the industry moves from the hands of the Government where it lay during the plant disposal period into the hands of private raw material companies. Because of this economic control of the basic resources we may see a few raw material companies putting a large new industry out of business, a result that would affect both the forest and power resources. Such a situation merits thorough investigation by the Congress.

Another major problem is that of coordinated development of our river basins. The difficulties and programs of each river basin are different from those of other basins. They must be met separately. For the Columbia River Basin where there are production and marketing agencies that could be competitive, where a pooling of all revenues is necessary for really full development of the region, the Secretary has come to the conclusion that when the people of the basin are eventually ready to support it, some form of river basin administration that will coordinate, but not supersede all the other agencies, is essential. The problems of the Missouri are quite different, and he has as yet made no recommendation for their most efficient handling. The Colorado is still in the stage of dispute and discussion about water rights, and it is hoped that the States both within the upper basin and the lower basin will come to an agreement on the most efficient use of the water.

All of these problems and dangers are matters of vital concern to all our citizens, for we all live on our natural resource base. They do not carry the impact of rapid change that the cotton South is facing. There the combination of tractors, mechanical cotton-pickers, flame-cultivators, other farm mechanization, and the change of the pattern to larger farms threatens to force two million farm workers into other occupations within 20 years. It might be possible for the Bureau of Reclamation to aid that situation somewhat by applying its long experience with drainage and irrigation to the swamplands of the South, and help bring in some useful additional acreage that would cushion the shock a little, and repay its costs to the Government.

We have grouped our problems and the programs to meet them under a few heads, which now follow. The yearly housekeeping reports of the agencies make up the part II of this annual report.

The Metal Mystery

Our industrial greatness was begun with the use of coal and iron ore in the East. It continued by sliding coal downhill and ferrying iron ore down the Great Lakes and manganese across the oceans to meet it. Alloying metals for steel came from the West, and copper from the West helped put electric power into almost every factory. Our industries chewed up vast quantities of lead and zinc from Missouri, Oklahoma, and Kansas. But the metal economy was not yet complete. During the Second World War aluminum went from 14,000 tons monthly to 94,000 tons to put our planes into the air. Magnesium went from 300 tons to 21,000 tons a month.

The war drain on metals was huge, comparable to the drain on petroleum. It has become a mystery to most students of the problem how we can go on being the greatest metal-using nation of the world when our reserves of copper, lead, and zinc are all seriously over-depleted and rising in cost, and when our best iron ore, in the Mesabi Range, is subject to exhaustion within another 20 years. There is even some thought that the barter process of the prewar decade that made gold our most valuable metal import, while the manufactured goods we exported drained our other mineral resources, should be arrested, and a new exchange sought. The suggestion has been made that our exported goods be paid for in raw materials, including minerals.

The mineral agencies of the Government (Geological Survey and Bureau of Mines) have worked out a series of approaches to the basic problem of assuring some continued national basis for our mineral and metal economy. The first of these steps is an inventory job on a national scale. It involves intensive work in discovery and examination of whatever mineral resources we may still have. The new geophysical methods, where they are applicable to minerals, will also be used. The war-time use of the airborne magnetometer for finding U-boats underwater is being applied to finding significant mineral deposits under land.

Before the discovery portion of the program can get very far there has to be more basic mapping of the geology of the Nation. At present less than 10 percent of the country has been mapped on scales adequate for the exploratory guidance now needed. In this respect, the United States ranks with the less industrialized nations of the world. In addition to basic mapping, some further work has to be done on the background of badly needed minerals so that we will know where to start looking. It involves securing data on reserves which mining companies have not yet made available to the Government, partly for fear of taxation by the several States which tax declared reserves in the ground rather than production only. It will involve drill-testing of many ore bodies. Above all, it involves putting cost tags on our resources, and making these cost tags take into account all the possible economies that can be obtained from newer mining and processing methods and from lower cost energy. At present many know that there are vast amounts of phosphate rock in the United States, but no Federal agency has ever attempted to draw a distinction in value to the Nation between rock that would cost $2 a ton to mine and rock that would cost $20 a ton. The present figures on American mineral reserves are therefore largely meaningless, even for a war economy when price is no object but the expenditure of effort and machinery still is.

This inventory job may cost a billion dollars, and would normally take 20 years to complete. It could be speeded up, however. At any rate, we would know what we have, and what it is worth. We would know also the degree of our actual dependence on foreign sources, the possibilities for a continued flourishing mining industry in this country, and possibly also the point at which substitutions of one mineral for another and of plastics for specific minerals can be expected to become important factors in our economy. The billion dollars would underwrite petroleum and coal as well as mineral inventories. The Geological Survey feels reasonably optimistic that the discovery of important new sources of both metallic and nonmetallic minerals will result from this work.

The depletion problem affects not only the mineral areas but also the metal working areas of the Lake States. Under Secretary Oscar Chapman has stated the Department's thought in this connection as follows:

"It is the hope of the Interior Department that new processes can be developed to bring into production low-grade domestic ores. We want to aid in doing that as much as possible, since otherwise large mining sections of this Nation will shut down, and the impact on the States and areas directly concerned will be disastrous locally, and will spread out over the rest of the Nation. We have no desire to hasten the increase of foreign minerals except in the form of stockpiles for security purposes. These would be critical and strategic minerals. At the same time we find it desirable to have sufficient foreign imports to allow our manufacturing industry to produce fully. We simply want the American mining industry to be kept operating on an economic basis as long as possible.

"The St. Lawrence Seaway and the power plant attached to it become important in this depletion picture in the following ways: Whenever, in the future, we are forced to go on an increased import basis, the whole metal fabricating industry of the lake area will unfortunately suffer a slow but profound shock. That shock will come from the preference that the coastal areas will acquire when foreign minerals are shipped to this country. They will arrive at the coast ports from abroad, instead of coming to the lake area from the Middle West or

Mountain area. The tendency will be for metal fabricating to move out of the lake area, particularly toward the east coast, to gain the advantage of the lowest costs.

"Such a movement would profoundly change the character of economic activity in the lake area. Such a movement would also put the mineral resources of the Middle West and the Mountain area farther away from their markets than they now are and force a lowering of their already very thin margin of profit to an impossible point. They simply cannot afford to absorb any more freight costs. The mineral areas of the Mountain and Middle West, therefore, stand to gain by any effort that will benefit the lake area. The St. Lawrence Seaway represents a stabilizing factor in the situation.

"The Department of the Interior has always favored a widespread mineral development of domestic resources. The mining industry is the basic industry in many of our Western States. I would be reluctant to see developments that would shut off that industry, but this seaway, with a maximum importation of 8,000,000 tons, of which only a small part will probably be used for minerals, will not result in any such shutdown. On the contrary, it will help the Western and Middle Western mining States to the exact extent that it helps keep the metal industry of the lake area just where it is now, close to the domestic sources of minerals."

The third part of the approach to a solution of the Nation's metal mystery is somewhat more audacious. It is that of adding values to our low-grade minerals by finding an entirely new use for them, much as the value to the Nation of uranium was increased immeasurably when its use shifted from an ingredient in the glass and pottery industries to a source of energy. It is pointed out that the possiblity of lowering costs enough to warrant converting low-grade American maganese into the equivalent of metallurgical foreign manganese for use as ferromanganese in steel making is to all intents and purposes impossible. But its conversion into electrolytic manganese, a new metal, with certain desirable properties all its own, is quite possible. The finding of a new use pattern is the missing part of this approach, and may be the essential requirement for the expansion of some of our nonindustralized regions.

The fourth approach has been taken by the Congress. It is that of authorizing continued subsidy payments to high-cost mineral producers and stock piling minerals for possible war needs. The Bureau of Mines provides statistical data and furnishes economic and technical advisers to assist the agencies directly charged with the administration of these programs.

The health and safety of mining personnel is also a major concern of the Bureau of Mines, although it has no authority to regulate mining operations. Accidents in mining are more frequent than in any other industry except lumbering, and are more severe than in any other with no exception. First-aid training has helped some. The dust that accompanies extraction is a health hazard in the metal mines and both a health and safety hazard in the coal mines. In addition to further education, the Bureau favors the introduction of rock dust into coal mines to prevent or limit explosions. This should be supplemented by wetting in some workings. More and better methods of mechanical ventilation should be adopted. Blasting should be done after a shift has left the mine or only after thorough wetting or rock dusting of the immediate region. Fumes should be removed by ventilation before workmen enter the working place.

There should be rigorous and periodical health examinations of miners. The Bureau notes that the accident rate has been going down and believes that "there is no question that accidents in the mining industry could be reduced at least 50 percent (possibly as much as 75 percent) below what they now are, in which event the financial savings would amount to millions of dollars annually to both workers and operators." In 1945, 1,034 men were killed in mine accidents. A 50-percent reduction would leave 517 men alive each year. A 75-percent reduction would leave 775 men alive each year. It should be noted that, in another resource field, a flood which has drowned 40 to 60 persons and threatens to do it again every 10 years or so has been found to be ample justification for the investment of hundreds of millions of dollars of public money.

Heat and Energy

The amount of energy used by a Nation is a good index of its industrial position in the world. The per capita use is a good indication of its potential standard of living. The future of the coal and petroleum industries depends to a large extent on the rate at which we increase our national use. In 1915 we had a national production of 17,100 trillion British thermal units. By 1929 it was 25,400 trillion, and did not get above that until 1940, when it was 25,600 trillion. During the war it was shoved up to 32,300 trillion. In other words it took us about 25 years to add 8,500 trillion and then in 5 more years we added on another 6,700 trillion, almost four-fifths of the 25-year increase. The war-time addition alone in 1945, if it had all been put into the form of electric energy, would have produced 447 billion kilowatt-hours, the equivalent of a herd of 68 million horses working every minute of the day and night.

To produce this additional heat and energy for the war, the coal industry went up from a 1940 production of 512.7 million tons to 630.9 million. The petroleum industry went up from 1.4 billion barrels to 1.7 billion barrels. The marketed production of natural gas increased from 2.6 trillion cubic feet to 3.7 trillion. Hydroelectric capacity was increased from 11,700,000 kilowatts to 14,900,000 kilowatts. Our energy increase (26.5 percent) between 1940 and 1945 was a little greater than our steel increase of 19 percent from 67 million tons to 79.7 million.

The very considerable war-time increases used up a large part of our best coking coal. They drew heavily upon our oil reserve and productive capacity. They used up a valuable part of our natural gas, although many new reserves were discovered. Meanwhile our current rate of petroleum discovery in new pools is only about one-half of our rate of use. We are living largely on past discoveries and the hope that there will be more, although we know that the rate of discovery has been going down. Our proved reserves are estimated at about 21 billion barrels, while in 1945 we used up 1.7 billion barrels, and peacetime expectations are for an even greater demand in the years ahead.

The mineral and conservation agencies of Interior see their first job in this field as that of helping to find more oil, gas, and coking coal, and to obtain better recovery from the resources that have been found. That is part of their discovery, inventory, and research program. The work of discovery has become more expensive and difficult. Geophysical instruments of various types have to be used over wide areas and with rigorous accuracy, and their evidence must be interpreted from a wide and imaginative geological background. The areas that seemed possibilities, certainly those with outcroppings or obvious favorable surface evidence of favorable structures, have already been examined and drilled. Among the great remaining hopes are two places, discovery of stratigraphic trap-oil pools far below the surface, and salt domes on the continental shelf under water adjacent to oil-bearing regions, in the Gulf of Mexico, Coast States, and existing fields in California. There is considerable optimistic opinion among geologists that we may hope to find about as much oil again in the future as we have in the past, in the range of 50 billion barrels, but it may cost much more to find and produce than it has cost up to now.

Exploration in the Western States is particularly important. As Secretary Krug has stated: "The war brought into sharp focus the strategic importance of oil supplies to operations in the Pacific area. It demonstrated the strategic significance of the fact that only one-fourth of the proved oil reserves of the United States are located in the Western States and that, elsewhere in the Western Hemisphere most of the oil supply is on the Atlantic, rather than on the Pacific side."

There are several other ways to increase our oil reserves in addition to discovering new deposits. One of these is secondary recovery of oil left in the ground after the original pressure has been exhausted. We know that there are several billion barrels of oil remaining in our older fields which were not recovered during the primary steps of production. The study of methods to make that oil more readily recoverable is worthy of our best scientific effort. At present in addition to water-flooding, the induced pressure of gas or air is utilized, and heat has been tried. These are engineering operations of considerable magnitude, and the improved recovery may require several years to materialize. The mineral agencies of the Government believe that they can aid in working out such secondary recoveries on public and private lands, in a way to benefit the whole industry.

The third approach is through a synthetic fuels program which will bring down the costs of producing oil from coal, oil-shale and asphaltic sands, to a place where it would be reasonably competitive with natural petroleum.

Congress has authorized the Bureau of Mines to work in this field and to use several pilot plants. The five-year program will cost about $30,000,000. The past experience of German plants is expected to be extremely helpful. At present large capital expenditures for work on synthetic fuels would be called for by individual companies, and while several private plants are being planned to produce synthetics from natural gas, the threat of a high rate of obsolescence for the early plants, due to advancing technology, may influence others to wait. In addition to the threat of rapid obsolescence, uncertainty about the future rate of oil discoveries and the stability of oil prices also act as deterrents to private investment in such experimental plants.

If decline in the supply of petroleum is not postponed by a very considerable improvement in our rate of discovery, and we have to go the synthetic route, a considerable geographical dislocation and relocation can be expected to take place, affecting employment, population movements and investments. If we had to get the equivalent of as much as one billion barrels of oil out of coal, at the rate of 1 ton of oil from every 4 tons of coal, a huge coal production of roughly 572 million tons would have to be added to our present annual production of about 550 million tons. That production would probably have to come from the areas where strip mining is possible, and costs are lowest.

The best present estimates of the Bureau of Mines of the cost of oil production are as follows, even assuming $1 per ton for strip-mined coal; and $0.50 per ton for oil shale:

From coal: $3–$4 per barrel (unrefined).

From oil shale: $2–$2.50 per barrel (unrefined).

In 1946 the Congress decided that the discovery of petroleum on public lands would be increased by revision of the mineral leasing law to set a fixed royalty on oil produced in place of the sliding scale previously existing.

The equivalent of replenishment of our own reserves may be secured in part by importations of oil. From the conservation viewpoint the extent to which we can produce oil without causing physical waste is a prime factor in measuring our needs for oil from outside sources. Late in the war period we were forced to overproduce our fields by about 300,000 barrels daily in order to meet military and essential civilian needs. For a short period we lost the benefits of well-organized production that we had gained through conservation in the late 1930's, when it had become clear that the overproduction in the industry was destroying the resource base as well as ruining the participants in the industry. Foreign supplies must be geared to the situation of the domestic oil industry as well as to the needs of the rest of the Nation's industries and homes. The need for such foreign supplies is obviously of a different order of magnitude today when we are using substantially all of our efficient productive capacity from what it was in the pre-war days when we had a reserve capacity of a million barrels daily that we could bring into production at any time. In this connection it is necessary for us to have reliable, disinterested yearly estimates of our efficient productive capacity.

Another part of the program of the industry and the States and Federal Government should be that of attempting to salvage and get into useful service more of the wasted gas that comes up with the oil. In 1943, about 684 billion cubic feet of natural gas were flared or otherwise wasted or lost. This is one-fifth of the total used. Translated into electric energy this is almost 50 billion kilowatt-hours, or over four times the 1945 production of the whole TVA system. Our wasted gas alone represents a lost energy about equivalent to the utility power used in the United Kingdom at present. The problem of collecting that gas (in addition to, and in competition with the natural gas already entering pipe lines) from widely scattered oil fields is one that we have never tried to meet. It would take from four or five Big Inch plus Little Big Inch pipe lines to carry it when and if it were to be collected. Or if, instead of being transported, it could be collected at a cost of 5 cents per thousand cubic feet and processed at or near the fields, it could produce over 68 million barrels of gasoline at a total cost of about 5 cents a gallon. The economic difficulty in the way of any conservation approach is that no incentive exists to produce either the gasoline that would come from the wasted natural gas, or to use the scattered gas from the oil fields, as long as natural gas from gas fields with an assured supply, and high pressure, can be had for a lower price.

This particular resource waste might stagger any nation less rich in resources. It equals in heat value about 113 million barrels of oil. It would equal three-quarters of the stripper-well production which qualified for subsidies under the stripper-well premium plan of OPA nd of the Defense Supplies Corporation. This amounted to 56,000,000 in 1945, and three-quarters of it would represent 42,000,000.

A final part of the program lies in the advance in the technology f use so that more service is obtained from each barrel than at present. ecretary Krug has said: "There should be no holding back in this ype of development. Once science has shown the way, the benefits f research in the better utilization of petroleum should be made available. Oil is too valuable to the Nation, too hard to find, and there s not enough of it to permit wasteful practices in its production, handling, and use." The Bureau of Mines is at present working on greater utilization of the marginal, lower-quality oils, and upon the adaptability of oils from the various producing areas to the manufacture of specific needed products. It is also working on the possibility of blending fuel from coal and oil shale with natural petroleum.

The oil industry does not expect to be competitive with the coal industry except in the fields of transportation and in residential and office heating, in which it also encounters the competition of the gas industry. Its preferable output is gasoline, Diesel oil and lubricants, rather than residual fuel oil. It is counting on adjusting its processes to meet the demand for jet propulsion which now utilizes kerosene, but may call forth a somewhat different product. Petroleum products are beginning to supply the base for a large chemical industry.

There is some expectation that in the course of time the domestic price will be increased and will allow far more discovery work, will keep the marginal producers in operation and will also get the synthetic production under way for coal and oil shale. One of the major interests of the industry is whether the synthetic production, which involves securing coal and oil shale as raw materials at very low costs, will be undertaken first by the coal-mining industry, the petroleum industry, or the chemical industry.

The natural gas industry is attempting to expand its outlets into Northern industrial cities. It is competitive in the heating field with oil and coal. Its bid for the Big Inch and Little Big Inch pipe lines has not been acted upon in a permanent fashion up to date of writing. It hopes to transport 400 million cubic feet daily through them, which is the equivalent in heat content of about 7,500,000 tons of coal annually. The continued expansion of natural gas northward has met with opposition from some producers of manufactured gas, some railroads, some coal operators and the miners. In some of the producing States also there is considerable discussion as to whether to encourage the export of this valuable and diminishing resource for use in other industrial areas, or to attempt to secure the advantages of the production of gasoline and chemicals from it near its origin. The Federal Power Commission has been charged by the Congress with examining the national significanc of the problems involved.

The President has established within the Department of the Interio an Oil and Gas Division to coordinate Federal duties and policies i these industries.

The greatest part of our national heat and energy still comes from coal. In 1945 it supplied about 49 percent of it. In that year 57 million tons of bituminous coal and 55 million tons of anthracite wer produced. The prewar production, in 1940, was respectively 461 million tons and 51 million tons. Byproduct coke went from 54 million tons to 72 million to help make our war-time steel supply.

The supply (disregarding costs of mining) is still vast. Anthracite reserves are still 15,730 million tons, of which 60 percent might be mined at a price. Gross bituminous reserves are estimated at 2,221,000 million tons. Lignite reserves are 939,500 million tons. No figures are available to show the estimated reserves that can be mined in the neighborhood of the approximate 1945 cost of $3.03 for deep bituminous coal or $6.21 for anthracite, or in the neighborhood of $2.30 for strip-mining The one great shortage is in good coking coal.

The Bureau of Mines expects that coal production will continue to increase slowly in a general way with the new high level of economic activity and the normal population growth. Between 1950 and 1960 it estimates a bituminous production of between 530 and 580 million tons, not including any call on the industry for coal to produce petroleum products.

The Bureau of Mines has a well-worked out program on coal, which it has been carrying out for many years. This program includes: (1) Improved mining practices, to reduce costs and loss of life and health; (2) improved coal preparation techniques, to reduce ash content and to make raw coal more valuable to the producer, and to save money in haulage of nonusable products. A reduction of 1 percent in ash content at the mines would save the freight bill on 6 million tons; (3) improved coal storage, to eliminate fires and make coal safer and cheaper for consumers; (4) studies of marginal coals to make possible their substitution for higher grade coals; (5) studies of coal combustion, including coal in powdered form to allow for more efficient and more economical use; (6) conversion of various types of coal and oil shale into petroleum products at the lowest possible cost; (7) studies of anticorrosion methods and feed-watering conditions to protect boilers using coal with corrosive elements; (8) studies of uses of the fine size of anthracite coal as a substitute for a portion of the low-volatile bituminous coal used in coke-oven charges; and (9) studies of the carbonizing properties of new coals for the benefit of coke-oven operators.

In addition, the Bureau of Mines believes that: (1) Further research is needed in the development of methods of treatment of high-sulfur coals that will either remove the sulfur or convert it into such form in he coke that it will not appear in the pig iron; (2) further research s also needed on the complete gasification of sub-bituminous coals and ignite; and (3) the possibility of using gas produced directly from coal still in the ground by a Russian process justifies some research. The product might be used for the production of energy or for synthesis of liquid fuels and other organic materials.

The bituminous coal industry had a large over-capacity during the depression years of the 1930's, which forced prices down and produced losses in large sections of it. For several years plans for minimum price control were developed, and such controls became effective in 1940. They were administered by the Bituminous Coal Division of the Department. They lasted through 1941 and then war requirements made maximum rather than minimum price control a national policy. Distribution of scarce coal became essential, and this was administered by the Solid Fuels Administration of this Department. The post-war situation has been very favorable to the industry to date, and no strong demand for minimum prices is expected unless a severe depression is encountered. The new high level of industrial activity in the Nation has narrowed the gap between capacity and requirements considerably, and there is no large overburden of idle capacity hanging over the price situation.

The mineral agencies of the Department are aware that competition between oil and coal can be expected in the near future. However, they believe that since it would be uneconomic for the petroleum industry to produce fuel oils as such, but only as byproducts of gasoline and then only at a minimum rate, the relative amount of such competition may decrease, and may be of less importance in the industrial fields in the future. In certain markets it may occasionally be a disruptive influence for the coal industry, but not on a national scale. Natural gas, however, may affect coal markets considerably until the processes have been developed which make its conversion into gasoline more profitable, or until it appears to be approaching exhaustion. In case coal is also called on to supply some of the petroleum requirements, losses to natural gas will be made up very rapidly, although possibly by other parts of the coal industry than those suffering the direct impact of natural gas.

Hydroelectric Power

In 1920 the Nation had a hydroelectric power production of 15.95 billion kilowatt-hours, in 1940 it was 47.74 billion, and in 1945 it had reached 79.97 billion. It went down from 36.8 percent of the total national utility production in 1920 to 32.9 percent in 1940, and went up to 36 percent in 1945.

The Department of the Interior and the Tennessee Valley Authority are the major Federal public power producers and marketing agencies.

The latter increased its system power, which includes steam plants, by 7.9 billion kilowatt-hours between fiscal years 1940 and 1945. Interior increased its system energy, which is all hydro, from 3,306 million to 17,819 million kilowatt-hours in the same period. This includes energy produced at Boulder Dam, which is not marketed by the Department, and energy at Army dams which is not produced by the Department but is marketed by it.

The Interior power agencies are located largely in the Western States. The Bureau of Reclamation has power plants in many of these States, from which it markets energy. The Bonneville Power Administration, which markets the energy produced by the Columbia River system, from dams built by Army Engineers and the Bureau of Reclamation, operates in Washington, Oregon, Idaho, and Montana. The Southwestern Power Administration, with headquarters in Tulsa, Okla., will market energy from the Arkansas-White-Red River systems in parts of Arkansas, Oklahoma, Texas, and parts of Louisiana, Missouri, and Kansas. In addition, Congress has directed the Secretary of the Interior to market the power from dams built by the Corps of Engineers. The major dams that have been authorized for construction by the Army Engineers lie in the area stretching in a crescent from Kentucky and Virginia down through the Carolinas, Georgia, and Alabama. It will also market energy from the huge Davis Dam power plant now being constructed by the Bureau of Reclamation on the Colorado River and from the Mountain Home, Hungry Horse, and other authorized projects of the Bureau.

A rough estimate of the possible growth in the hydro system under the management of Interior can be made for the next 15 years, on the basis of only present authorizations by the Congress.

[Millions of kilowatt-hours]

	Fiscal year		
	1940	1946	1960
Bureau of Reclamation (excluding the Columbia)	3,052	7,886	18,446
Bonneville Power Administration (including the Columbia)	208	6,236	29,828
Southwestern Power Administration	0	736	2,567
Southeastern Army projects	0	0	4,319
Total	3,260	14,858	55,160

If the fuel used in place of this hydropower were oil, the saving would have ranged from 8.6 million barrels in 1940 to 39.1 million in 1946, and will be in the neighborhood of 145.2 million barrels in 1960, estimating 380 kilowatt-hours per barrel.

The Government's investment in the power portions of the dams, and in the transmission lines and substations was approximately 428.5 million dollars in 1946.

The waterpower resources of the Nation were among the few that were not depleted by the war; instead their utilization was increased. They helped to win it and they remain after the war as major assets of the regions and the Nation. A slight postwar decline in power use was expected, but it now appears that this will be temporary. In 1946, partly due to the return to Shasta Dam of the generators which had been installed in Coulee during the war, the Pacific Northwest was so short of power that every oil-burning reserve plant was operating, and only a small fraction of the normal reserves was available in case of trouble. The continued demand for aluminum for peacetime uses, including housing, is largely responsible for this shortage. When electric appliances are again available it is expected that the demand will increase far above the prewar rate.

The great power programs of the Federal Government are expected to add within 20 years, 3.7 million kilowatts of capacity to the Colorado River area, 7.5 million to the Columbia, 1.8 million to the Missouri, 1.4 million to the Arkansas-White-Red area, 1.7 million to California and 4.7 million to the Southeast, a total of about 20.8 million kilowatts. This addition represents twice as much hydroelectric capacity as the whole Nation had in 1936.

There are five major problems which have to be considered with a program of this size, and of this potential significance to the Nation.

The first deals with the basic usefulness of low-cost public power in stimulating the regions where the power is located to new industrial growth. As it happens, almost all of Interior's programs are in areas which need and want a considerable amount of new industry. That includes the Pacific Northwest, the Missouri, the Southwest, and the Southeast. To create new industrial developments, particularly in the areas where agriculture and industry are out of balance and population and markets are still small, requires a very low rate for energy. Not all of the rivers are miracles like the Columbia which has a tremendous volume of water all the year round and maintains a heavy run-off in the summer months. Many of them are flashy and irregular, producing little firm energy. To secure their full benefits for the region and to prevent waste of resources in the streams the Department has found it necessary to plan to have steam plants tied in with the hydroplants. This is true of the Arkansas-White-Red River systems, and of the Sacramento River in California—where most of the river has been dedicated to the use of navigation, salinity repulsion and irrigation, and some of the Shasta Reservoir to flood control storage space—with the result that but little firm water is available to improve the quality and value of the hydroenergy. Similarly, the rivers of the Southeast must be supplemented by steam plants to produce large quantities of firm power. While th Congress has appropriated funds for a considerable number of sucl firming steam plants in the Tennessee Valley, none has been built as ye for the Interior systems.

The second problem, of increasing the value of the energy to th region through steam plants, is intimately connected with the first problem, of getting low-cost power out of the rivers. The first problen has increased in difficulty because of the rise in price levels. Dams ma now cost from 50 to 80 percent more to construct than they did ir 1940. If such dams were to be constructed as emergency public work projects, in times of depression and of low prices, as Bonneville, Coulee and most of the Tennessee Valley dams were constructed, there would be no cost problem. However, most of them have flood control and navigation functions which cannot be postponed indefinitely. In additior they have power functions, and the growing power demands of th regions call for more sources of power, promptly. If these additiona necessary power plants are built by the utilities because of postponement of hydro projects, the utilities will suffer when the lower-cost hydroplants are finally built, or rather, if they are built before the steam plant capacity has been absorbed. If on the other hand, the hydroplants are built regardless of cost, because of the need, the benefits of lowe cost power for the region are likely to evaporate, in case there is an overall lowering of the price level. In some cases low-cost upstream storage may improve the situation.

The third problem is that of efficient timing, construction and management of multiple-purpose projects. It is the job of squeezing every drop of moisture and every ounce of energy out of the rivers. The concept of use for all purposes is a basic one in our conservation policy. Untamed rivers have been a savage destructive force. They have caused large damages to property. They have taken many lives. They have washed away precious topsoil. Every year 600 million tons of topsoil still find their way into the Gulf of Mexico. In the West flood waters rush past dry land that needs only water to make it prosperous. Development of a river as a unit means that instead of considering only flood control, or navigation or irrigation or power, an attempt is made to get the greatest amount of all of them that is possible by combination. In addition, fish life has to be protected by regular run-offs in the spawning season and by fishladders around dams. In some rivers enough water has to be provided to push down the incoming tides and save land from being permeated by salt water. In most rivers, water for municipal and mining and industrial uses has to be made available. There are also pollution problems, and recreation facilities to be considered. State interests in the water have to be protected.

A series of studies are now being made of major river basins looking towards their proper development in order that each may yield the ultimate benefits of which it is capable. Reaching the correct answer to the various problems presented is difficult and complex because of the number of Federal agencies and State bodies involved. The planning for flood control and navigation is under the Corps of Engineers. The planning for irrigation and part of the power is under the Bureau of Reclamation. The study of the power markets and the authority to recommend power installations in War Department dams is under the Federal Power Commission.

The Department of the Interior which has the responsibility of marketing the power is not in a position to control the many factors which are involved in its cost. In order that the most efficient over-all job be done in connection with the sale of power from these multiple-purpose projects it is extremely essential that the Department of the Interior, as the marketing agent, should participate actively in (*a*) the original preliminary studies, (*b*) the choice of the most desirable projects, (*c*) the determination of the size and character of the electrical facilities, (*d*) the timing of their submission to the Congress for approval, (*e*) the allocation of their costs, (*f*) their accounting and repayment, and in addition, (*g*) should share responsibility for the timing of the installation of power units, (*h*) the characteristics of the electrical facilities, and (*i*) be responsible for the operation of the projects for power purposes.

A recognition of some of these difficulties has brought about a working agreement and the formation of what is known as the Federal Inter-Agency River Basin Committee, consisting of representatives of the Army Engineers, the Department of Agriculture, the Federal Power Commission, and the Department of the Interior. This has formed the basis for a better coordination of the programs of the affected agencies and closer integration of policies. It is a very large field and the work is by no means complete. Much remains to be done before the maximum benefits from fully developed river basins can be realized.

On the Columbia a magnificent combination was made some years ago where Coulee Dam adjoins a million acres of dry land. Huge quantities of water, about 4 million acre feet, will be pumped up to serve that land, and will flow through costly reservoirs, canals, and ditches. The original nonunit river development plan was for a low dam for irrigation purposes only. The irrigators would have had to pay the cost of the dam and of all the irrigation works themselves, or about $630 per acre. The plan actually adopted was for a high dam which will have a capacity of over 2 million kilowatts of power, and will pay $222 per acre for the irrigators, who will themselves only have to pay an average of $85 per acre. At the same time the high dam backs up such a large lake of water (9.5 million acre-feet) that it will firm up energy for all the future dams that will be built in the course of time on the river below Coulee. These, in turn, as they come into being, will be in a position to pay for the storage value to them of the Coulee Reservoir.

Columbia energy may be responsible for another type of direct conservation effort. At present the total energy utilized for all purposes in the Pacific Northwest is split 12 percent hydroelectric energy, 33 percent oil, 21 percent coal, 34 percent wood. The increase in hydro-production saves oil. Yet wood is one of the most valuable resources of the area. It has been increasing in price. Through the development of wood waste for chemicals, instead of using it to produce steam in the pulp mills, industries are being added to the area. The Bonneville Power Administration, which markets the power of the Columbia River system, consequently plans to conserve this raw material by sending energy to the pulp mills (except in low-water years) at a rate in the neighborhood of 1½ mills per kilowatt-hour. In addition to that, it expects in time to offer a relatively low rate for home heating which should also save wood waste. That home-heating rate in turn will be made possible by, and will make possible, a low-summer rate for sprinkler irrigation which will be of major advantage to vegetable and fruit growers in the area.

A fourth major problem is the relation of new Federal power developments to private utilities operating in the area. They usually take the position that they should be the sole or major distributors of the energy, and propose to take their lines right up to the Federal dams. This would tend to restrict the sale of Federal power to these distributors. On every occasion that the problem has been presented to the Congress in legislative form it has decided that preference in use (not in rates) should go to public bodies such as municipalities and cooperatives, and since these could not economically construct high tension lines to the dam, the public marketing agency should be authorized to build such lines to the market, and also to interconnect various hydroprojects with its own lines in order to get the fullest value out of the combination. In 1944 in the Flood Control Act of that year, the Congress designated Interior as the marketing agency for all energy at reservoir projects constructed by the Army Engineers, and wrote into this act the preference for public bodies. The Department of the Interior has taken the position that the various acts of Congress affecting public power lay upon it an obligation to get low-cost energy to the whole region, with preferences to public bodies. It sees equality of access to the power, as represented by public high-tension lines, as a necessary part of this obligation. The Department is interested in wholesale and very large individual industrial use, and not in general distribution. It sees no departmental conflict with the private utilities in the distribution field.

The public power dams and lines are paid off in 50 to 60 years with nterest ranging from 2.5 to 3 percent. The power portions of the tructures are then entirely debt free, and in good operating condition.

A fifth problem of importance lies in the relationship which power consumers have to water users. For the most part, the power brought n on western rivers has been of such a distinct advantage to the power users that they could make a contribution in the form of aid to water users and still have a very considerable power benefit. The notable example is at Coulee Dam where the power users will pay an extra one-twenty-fifth of a cent per kilowatt-hour and thereby make possible the development of a million acres of land and a number of communities that would not otherwise have been possible. However, there are few dams as large and economical as Coulee, and the rising price level will make it harder for consumers of higher cost power to contribute as heavily ($228,000,000) as Coulee contributes to irrigation. A complicating factor in the situation is that while construction costs are being incurred at high price levels, there is no certainty about agricultural prices, and consequently about the ability of the water users to repay a certain portion of the capital costs, and yet the water users have to accept their portion of the obligation before the projects are undertaken.

A forward step in the Flood Control Act of 1944 makes it possible for low-cost units of the Missouri Basin project to help carry the high-cost units in a pooling operation. This gives every irrigating farmer who lives in the arid part of the basin an equal opportunity to gain advantage from the power drops in the river, regardless of the fact that he may happen to live many hundreds of miles away from the steepest, and most valuable power heads. Similar pooling arrangements for the Colorado and Columbia Basins should be made.

The much discussed relationship of hydroelectric energy to other energy sources, does not yet rise to the heights of a major problem. In the West where most of the undeveloped water resources are located, the oil saving which they make is obviously desirable from a conservation viewpoint. They rarely affect coal. In the Arkansas-Oklahoma area they are on the edge of the low-cost natural gas region. The dams in that area are mainly flood control and navigation structures and probably would be built even if no power could have been produced as a by-product and paying partner. The shortage in capacity means that hydropower might take a part of the future market from natural gas rather than the present market. A future hydroproduction of 4,808 million kilowatt-hours would require steam capacity consuming 80,590 million cubic feet of gas. However, since gas has a very low employment rate, the result is not of major importance to the stability of the economic structure. In the Missouri Basin most of the hydroenergy will have to find new markets for itself. Some small part of it might replace old coal- or oil-burning power plants. It is too early to estimate accurately, but if this amounted to a fifth of the total, or about 1.2 billion kilowatt-hours, it would represent the equivalent of 780,000 tons of coal annually. If the whole 6 billion kilowatt-hours on the Missouri were considered as impinging on the future coal market, the effect would be to eliminate 3,900,000 tons of coal. That is still much less than 1 percent of the national coal production.

In the Southeast the proposed Army dams will not produce exceptionally low cost power. Costs will range around 5 to 6 mills. If as much as 4 billion kilowatt-hours are produced, and if all of it is to be considered as affecting future coal markets, a total of 2,600,000 tons of coal would be displaced. A considerable part of hydro prospects in the Southeast are economically sound only for capacity power. The only other major hydro possibility in the whole East is the St. Lawrence. This would produce about 13.2 billion kilowatt-hours for use in both the United States and Canada. It would be very low-cost energy. If the whole production of the project were assumed, to cut into future coal markets which would not be the case, it would displace only 8,580,000 tons.

While the whole potential hydro competition for future coal markets, at its most extreme, could be estimated in the neighborhood of 15,500,000 tons, this still represents less than 3 percent of the expected coal production, moreover it should be emphasized that this estimate represents only a few years growth of expected coal production, that it would be only enough coal to produce a small quantity of oil, in case the coal industry is to be drawn on for oil production, and, finally, that increased use of hydroenergy has normally brought with it an increased use of coal for firming hydropower and for the added commercial and domestic use that accompanies industrial growth. It might also be pointed out that in the 15 to 20 years during which these hydropower installations will be made, the steam electric utility industry, through its improved efficiency of use on any rate comparable with the past rate of 3 percent annually, will itself cut into future coal market expectations by over 30 million tons annually, or about twice as much as all the hydrodevelopments could effect under most extreme estimates.

Land Under Water

Another 20 years may see an additional 20 million people among us, and these new people will need millions of new acres of cropland to feed them. More land as well as better land, or more food imports, are going to be national "musts."

Putting water on the rich soil of arid Western States is one of the best ways to bring needed land into national use. It puts a solid crop base nderneath the cattle, mineral, and lumber economy of the Western tates. It has the additional advantage of bringing in land in the West hich is growing in population, and which has generally imported a arge part of its food needs. At present there are about 21 million acres nder irrigation. The Bureau of Reclamation furnishes water to about million of the total, the Office of Indian Affairs administers about 50,000. The Bureau has another 5 million acres in prospect, the In- ians another 750,000 acres. Early irrigators found that water poured n the dry lands of the west brought forth rich crops. Thus many pioneer irrigation systems were built hurriedly without the hydrologic studies hat are a commonplace in irrigation development today so that in dry years the demand for water far outran the supply. Nearly 10 million acres, principally on non-Federal systems, are farmed with insufficient rrigation water. The Bureau plans a major resource rescue operation o bring supplementary water to these lands.

Possibly Congress will allow as much as 5 billion dollars to be invested through the Bureau of Reclamation in the course of the next 15 years. Of this total, projects which will cost 2.5 billion dollars to complete have already been authorized. Some of the investment will be in dams which perform flood control, navigation, and siltation functions or which produce power. The reclamation and power features are paid back into the Treasury over a 50- to 60-year period. A portion of the power revenues are usually set aside to help the irrigators pay off their obligations. On the great Columbia Basin project in eastern Washington, where 1,000,000 acres will come into production in what is now a sagebrush desert, power from Coulee Dam will contribute 228 million dollars to the repayment of the capital costs, and the irrigators 87.5 million dollars.

The capacity of the Bureau's hydroplants was increased during the war from 1,160,000 to 2,250,000 kilowatts. They saved 36.5 million barrels of fuel oil in 1945 alone when 14 billion kilowatts were generated in those plants. The Coulee and Boulder plants produced enormous amounts of energy that went directly into weapons of war.

Like other agricultural areas, the reclamation lands suffered somewhat during the war from upset of crop balance, reduction of maintenance, shortages of fertilizer, omission of cover crops and heavier production of soil depleting crops. Many of the areas were stopped in their development by war demands that took the steel and labor they needed for expansion or protection. Those hundreds of thousands of acres are still suffering from deficient water, or from seepage, alkali deposition or salt intrusion, and will continue to depreciate in value until canals are built and water is delivered.

In spite of war-time troubles the settlers in Bureau projects produced during the war 13.6 million bushels of beans, 124.5 million of grains, 16.6 million of seeds, 373.4 million bushels of vegetables, and also 7.9

million tons of sugar beets, 12.6 million tons of alfalfa, 2.2 million to of forage crops, 2.5 million tons of fruits and nuts as well as 670.5 m lion bales of cotton. The alfalfa and forage crops alone were enoug to produce 150 pounds of meat per man for an army of 4 million men f 4 years.

The process of bringing great new resources into being is not withou its problems. One of the major difficulties in securing all the possib benefits from a river basin is that two, three, or even four Federal agenci have been given jobs by the Congress that affect seriously any over-a basin development. Water put on thirsty land, and power to help pa for the land development and yet be sold at rates low enough to stimulat high industrial and residential use, seem most important to the Depar ment of the Interior. The Fish and Wildlife Service wants a minimu of damage done to fish and fowl, and compensatory investment wher the damage is unavoidable. The Indians do not want their base land flooded out by reservoirs without receiving equally good lands else where. Navigation and flood control are the major interests of th Army Engineers, but they also have plans to build purely power struc tures. The Soil Conservation Service is interested in preventing erosio and consequent siltation in the reservoirs. The Federal Power Commis sion advises the Army Engineers on power structures and reviews rate on energy production at their dams. In the Columbia Basin there i a separate power marketing agency, the Bonneville Power Administration; in the Colorado Basin, the city of Los Angeles and the Arizona Power Authority are interested in marketing large portions of the output.

In programs of such magnitude conflicts must inevitably occur. Major differences between Federal Agencies, between States, between local groups, have developed as expected in all of the major river basins. Certain of these differences such as those on the Colorado River involve the rights of soverign States and can only be resolved by inter-state treaties. A compact commission headed by former Commissioner of Reclamation Harry Bashore is at work preparing an inter-State allocation of the waters of the upper basin. Conflict over construction of Foster Creek Dam on the Columbia was resolved by the Congress. Fishing interests have sought postponement of Umatilla, a major navigation and power dam, and of five minor navigation dams on the Lower Snake, pending consideration of the possibility of reorienting salmon runs into the lower tributaries of the coastwise rivers. Studies of pollution, location of other prospective dams on those streams, and completion of biological investigations, are involved in making this choice. Repayment of irrigation costs in the semihumid Missouri Basin is a major problem. In the Central Valley of California the basic tenet of Reclamation law that water shall only be furnished to family-sized farms is being vigorously questioned by proponents of the large farm pattern.

These conflicts are not irreconcilable. Machinery for their solution by democratic processes providing for the participation of various Federal agencies and States in the formulation and development of comprehensive basin plans has been set up under the Flood Control Act of 1944. Coordination of State and Federal planning is secured through the operations of the Federal Inter-Agency River Basin Committee comprising the Departments of the Interior, Agriculture, and War, the Federal Power Commission, and the Governors of the States affected in each case. Within the Department of the Interior there exists the Missouri Basin Field Committee and the Water Resources Committee to adjust and evaluate the interests of the agencies involved. The Columbia Basin Inter-Agency Committee is working at solution of the manifold problems involved in that great valley development.

This technique is an adventure in cooperation. All the conflicting voices are heard. All the points of view of every affected interest are reflected in the reports that go to the Congress. Where the differences are so great that they cannot successfully be compromised, the final decision is rendered by the elected representatives of the people. It has been operating now for a little more than 2 years, not long enough to demonstrate its full potentialities in river basin development.

Another major problem is that of providing the benefits to each area which can come from relatively low power charges. Congressional legislative policy has been in favor of public transmission lines to carry energy from dams to municipalities, electrical cooperatives and other public agencies, instead of blocking up the energy at the dams. However, in the individual cases of the Arkansas Valley and the Central Valley of California funds for these lines have been difficult to secure. Interconnections with adjoining basins may be possible in time, now that long distance transmission is becoming more feasible. The problem of stimulating regions industrially through low-cost power is particularly urgent on rivers such as the Arkansas, Red and White, where the flow is irregular and flashy, and considerable reservoir storage has to be left empty for flood control, and on the Sacramento where prior commitments have been made to let down water for navigation, salinity control, irrigation, and fish protection, and little remains in reserve for power alone. In these areas the Department believes that steam plants are necessary to firm up the hydro energy in order to secure the major advantages of the river to the people of the region.

Part of this problem lies in the fact that our basic irrigation pattern is changing. We are planning to pump uphill for irrigation use a large part of the Columbia, the Sacramento, the Missouri and possibly the Colorado. Power now appears in its true role as the working partner of irrigation. Great blocks of energy are put to work on the Reclamation project pumping water, which could otherwise produce large commercial revenues.

A problem that still lies undiscussed in the background of Feder loans for great multiple purpose reclamation projects is the exte to which such an investment should be used to produce in part certai crops which are in peacetime subsidized in one form or another.

Over the next few decades the water put on land in the West an guided through turbines ought to put a new face on all of our grea western river basins, the Arkansas, the Colorado, the Columbia, th Missouri, and many lesser streams. It will make our farms more live able and more profitable. It will hold people in States that have bee losing population. It will feed all of us better. The job of buildin great dams itself stirs the imagination of man. The job of getting th most out of the rivers for the people should do so, too.

One of the main objectives of the Bureau of Reclamation is close knit interdevelopment of town and country, of small business, smal industry, and farms. This establishes an area in which the greates possible number of people may enjoy a good livelihood. This is th primary aim of the acreage restriction of reclamation law, which i occasionally attacked. Stated in simplest terms, this law limits to 16 acres or less the amount of land held in one ownership that can b supplied with irrigation water from a Bureau of Reclamation project Acreage restriction is basic to conservation of land resources. By preventing consolidation of individual farms into huge holdings with attendant evils of tenancy, sharecropping, and monopolistic control, i furthers stable settlement, conservative treatment of the soil, and maximum utilization of land resources. Rural and urban areas in the vicinity of reclamation projects receive mutual support. The townspeople provide a ready market for farm products. The independent farm owner-operators have greater purchasing power and require local enterprises to supply them more than an equivalent community of tenants or hired hands.

Extension of predevelopment work to all projects opening new land to cultivation is strongly urged. Successful settlement of irrigated land requires production of salable crops the first year. This is necessary to enable the settler to pay his living expenses, establish a home, and meet construction and operation and maintenance charges as they become due. Hasty, inadequate, and improper preparation of the land for irrigation, however, results in irreparable damage to the individual farm and to the project as a whole. The proper development of raw public land for irrigation frequently calls for heavy equipment that the farmer cannot afford to buy. The Bureau of Reclamation has been authorized to undertake reimbursable predevelopment of some public land homesteads. This includes rough clearing and leveling, roughing-in of farm distribution systems, and protection against water and wind erosion. Work that the settler can satisfactorily perform with ordinary farm equipment is not included in this program. Orderly, planned development of the land resources and conservation of the limited water supply is facilitated by initial preparation.

The great programs of the Bureau of Reclamation include bringing 5,360,000 acres into cultivation or stability in the Columbia River Basin. Of this 3,840,000 acres are new land and 1,520,000 acres are land which will receive supplemental water. The plans for the Missouri look to the transformation, by irrigation, of more than 5,000,000 acres of range and dry lands into steady wealth-producing irrigated lands which will stabilize the living for 400,000 families. In the Colorado River Basin, after the States settle their uncertainties concerning water rights, the Bureau of Reclamation stands ready to aid in bringing in 1,533,960 acres of new land and of putting supplemental water on an additional 1,122,270 acres. In the Central Valley of California, the Bureau's program will furnish water to 550,000 acres of new land and to 1,550,000 acres of land requiring supplemental water.

Home on the Range

Much of our red meat eats off the Government. One beef animal in every five and two sheep in every five get about 4 months of their feeding each year in the public domain, and in spite of the low quality of most of the range, get it for very little. There are 145,000,000 acres of Federal range lands, and the beef animals pay an average of 20 cents and the sheep 4 cents a season. The Grazing Service of this Department (which was amalgamated in July 1946 with the General Land Office into the Bureau of Land Management, and cut heavily in staff) administered 60 grazing districts. In addition to the Federal land it covered 119 million acres of State and private lands. The total area was 264,000,000 acres. That is an area greater than Colorado, Wyoming, and Montana combined. It is largely in the arid part of the West.

Meat consumption has gone up during the war. With over 120 pounds for each person we took our place alongside the Australians and New Zealanders as the greatest meat eaters in history. There is going to be continued public demand to keep that rate. Every million people added to our population wants to eat the equivalent of 150,000 steers, and that means another 12,000,000 acres put into the range-alfalfa-corn-feed lot complex. Our population may go up by 20 million persons in the next 20 years before it levels off, and the necessary 240,000,000 additional acres for meat are not going to be easy to find. Already many of our western irrigation projects are becoming winter-feed growing centers for the surrounding dry-land range. Submarginal eastern and southern land can and will be put into pasture. However, the great bulk of the needed feed will have to come from improvement of the quality of the western range.

But the public range does not take care of itself. It can be, and ha been overcrowded and overgrazed until it can no longer carry a norma load. The overgrazing led to erosion. During the past war years, th range came through in pretty good shape. It was not ploughed up i important parts as it was during the first World War. Not much wa done to prevent continued erosion, but no new bases for ruin were lai The Federal range may now be considered to be not more than 50 percen efficient for its purposes.

The range needs seeding with grasses adapted to each area and climate. Instead of 10 acres of sagebrush land feeding one cow one mont we need planted forage where two acres of grass will do exactly the wor of 10 acres of sagebrush. It needs more waterholes, trails and fences although already fences have been put up long enough to cross the continent twice, and trails enough to cross it about four times. Some tw million acres borrowed by the military services will have to be rehabilitated. All the improvement work plus increased security of range le to better terms on cattle loans, and contributed to the stability of th industry.

The basic pattern of public range use in the Western States is individual ownership of lands producing forage for winter use and ope public domain range in the grazing districts and national forests fo the remainder of the year although several million livestock, mostly sheep, use the semidesert Federal ranges in winter. There is complete interdependence, except in the Southwest, where much of the range is available all year round and became part of the individually owned base properties. The Taylor Grazing Act of 1934 recognized this interdependence, and gave preference in the public range to individuals or companies already owning base lands nearby. But there was more base property than range, so priorities of use were applied, limited by the amount of livestock which had been run on the range. Those with base properties but without priority came next. There has been relatively little land available for the second group. Newcomers into the livestock industry have to buy their way in through the acquisition of base properties.

The industry is not entirely in a few large hands. Over three-fourths of the number of grazing permits are in the hands of men with less than 200 animal units, which is about the economic bottom limit for a herd. They average 55 units. But the remaining 25 percent of the users graze three-quarters of the units and average 557 units. The basic legislation does not give preference of any type to the small ranch owner or cattle homesteader. There is no limit to the amount of range that can be leased to an individual or company which has sufficient base lands even if it acquires these base lands from others. The United States Forest Service has developed an administrative system on the grazing lands in the national forests which gives some preference to small ranchers, but no great permanent increase in the number of small permit holders has resulted. This may well be due to the fact that 200 animal units constitute an economic bottom limit, and small holders cannot acquire the additional basic land and consequently the range permits for such a number.

The housekeeping job to be done on the range includes not only seeding and forage increase, water holes, fence and trails, but protection against range fires. These still burn vast areas. Usually the reseeding process should follow such fires. After fires the grass or seeds present usually grow with vigor, but there is seldom sufficient of either, or of the proper kind, to make up the loss. Rodent control and control of predatory animals are also part of the job.

One of the major public problems at present is the future of about 200 million acres of public domain. Much of this land can be a valuable national resource if it is well-administered, brought into condition, and kept that way. The costs of doing that are repaid annually in profits to livestock raisers. The fees collected for use of the land have been low.

The Department, with years of land-management experience, believes that there is a suitable use and a public interest in all forms of land. It is convinced that sound and forward-looking national policy demands that these lands be administered as a whole, that they be administered well, and that the Federal Government should have responsibility for what is basically an interstate task.

Land Without People

In addition to 145 million acres of lands in Federal grazing districts and 56 million acres of Indian land, this Department supervises about 83 million acres of forest, mineral bearing, and other unclassified land in the continental United States, and another 344 million acres in Alaska. In the main, this is the last remaining part of the "public domain," the land which nobody wanted very much, the land without people. This remnant on the continent is a tiny fraction of the old public domain of 1.4 billion acres. It has 20 million acres of forests, but does not include the 170 million acres of national forests which are under the supervision of the United States Forest Service in the Department of Agriculture. It does include about 14 million acres of national parks and 6 to 7 million acres of wildlife refuges and game ranges.

Much of this remnant of 83 million acres (the size of New Mexico) has never been surveyed in detail. Much of it has never been classified as to its possible use. The basic problem here is: What is the best use for it? Its optimum use for the Nation is not known. By and large the Government has given parts of it away whenever anybody wanted it, and has also given away the mineral rights to large portions of it. During the war the military services found about 32 million acres in the United States and Alaska useful for their purposes.

The Department's program is first, to get the best of all this land classified so that areas appropriate for grazing can be used for grazing, either adding potential forest lands to present forests or to sustained yield units, any possible overlooked agricultural land can be segregated out for pioneering soil breakers, and any particularly good recreational opportunities can be more fully appraised. This land classification job might cost as much as $7,000,000 in the United States. The same job, which has been started in Alaska, should be speeded up if veterans and other prospective settlers are to be spared the disappointment of seeking to establish homes on lands unsuited for this purpose.

The second part of the Department's program is to get the mineral bearing parts of this land (and of the much larger grazing area) segregated out, and a conservation policy worked out that will put the mineral resources to use as the Nation needs them.

Third, the forest woodlands are to be used to produce their fair share of the lumber and other wood needs of the Nation, but are not to be sacrificed through overcutting. These Interior lands with about 31 million acres of woodland and 16 million acres of Indian-owned lands produced about one billion board-feet in 1945. Sustained yield management is to be maintained or established. Cooperative agreements to cover adjacent or intermingled private forest lands are to be pushed in the interests of a stable and nonmigratory lumber and wood industry. Forest surveys and inventories are to be continued until all the forest land has been covered. Restudy of the "in lieu" tax payments to States is to be undertaken. Fire, disease, and insect protection is to be continued and expanded. The first parts of this program are revenue producing ($3,400,000 in 1946) and far more than cover the cost of forestry management. The second part costs money ($1,200,000 in 1946) which produces revenues in future years by preventing losses.

Fourth, this area, along with the wide grazing lands, is to be protected from further erosion where that is economically possible and desirable. In addition to check dams and other preventive methods, a great amount of reseeding has to be done. This can be speeded up, and also be done most economically by plane. We have gone back to the birds. Seed for trees and grasses is wrapped in pellets of fertilizer with a little poison to prevent its destruction by insects, and dropped where it is needed. The force of the drop gets the pellet on the surface, where it waits there until rain activates it. The cost of seeding by this method is about $2 per acre, compared to $4 for seeding with ordinary farm machinery. Some years will be needed to test the advantage of this pellet method on range lands.

This land, plus the grazing land, plus the Indian lands, totals 282 million acres which are under the Department of the Interior. They do not include lands in Alaska. More than 2 acres in 10 (60 million) are in critical erosion condition. Three other acres out of every ten need treatment to restore them to maximum productivity. Conservation work has started on 11 million acres and is planned for another 49 million. But at the rate we are going, we can never expect to catch up with the job. In 1946, only 1.2 million acres were being treated. Meanwhile 73 million acres were getting progressively worse. The cost of treatment is about $1.50 per acre, and an investment of $90,000,000 is needed for the worst 60 million acres and another $110,000,000 for the rest. This work through decreased siltation, ought to save the value of many of the hundreds of millions of dollars invested, and to be invested, in storage reservoirs and power plants.

The final part of the Department's land program deals with getting the underlying mineral resources into use in a manner that will lead to their aiding the national economy. The goal is public benefit through individual development. At present the situation is that anybody can file a mining claim, on public lands, and through a certain amount of work on it, can secure full rights to it.

Under the terms of the mineral leasing act, as amended, the Department is authorized to lease for development lands containing oil, gas, oil shale, coal, potash, sodium, sulphur and phosphate. The terms and manner of lease vary. Generally where the lands are not actually known to contain these minerals, the one who applies for a lease first, secures it. Where the lands are known to contain oil and gas and other minerals, the leases are sold at auction to the highest bidder. Under this plan thousands of acres are now subject to lease for oil and gas, coal and other minerals, and a substantial revenue is returned to the Government through royalties and bonuses (where lands are sold to the highest bidder). The revenues, although deposited in the Federal Treasury, are distributed, 37½ percent to the States, and 52½ percent to the reclamation fund and the remainder is retained in the general fund.

In order to permit exploration by governmental agencies or to reserve deposits for future development, the Department, on occasion, has recommended the withdrawal of certain areas. Because of the intense national interest and security which is involved in the case of radio active materials which are fissionable, the Department has suggested their total reservation in the Government through legislation.

The Department's general policy with regard to withdrawing lands and minerals has undergone revision in procedure, and at the end of the fiscal year was being shaped toward a policy (announced on July 24, 1946, by Department Order No. 2232), calling for careful consideration prior to the withdrawal of public lands, an opportunity for protest by the individuals or public agencies which may be affected, and public hearing in appropriate cases. A national inventory and cost tagging of the mineral resources on the public domain, referred to in the metals section of this introduction, is, of course, part of the land program.

The Department and the mineral industry have both been perplexed by the effect that the changing conservation technology of both oil and mineral extraction is having on the opening of the remaining public domain. The tradition is against monopolization of the public domain, and that tradition is expressed in laws limiting, sometimes ineffectively, the amount of public domain that can be put into any one hand. Yet good modern conservation practice requires that an oil pool be managed as a unit. Further, the cost of discovering the remaining oil resources is so great, and the geological and geophysical work so complex, that only the larger companies can afford it. They naturally want to protect any discoveries which they may make by securing large land holdings in the area. From the conservation viewpoint the operation of small mineral or coal holdings also creates a situation which may not always be in the national interest. The company or individual which is not well-financed may mine the outcroppings of the coal or mineral deposits and leave the thinner and deeper resources untouched, and perhaps flooded. Under these circumstances, it is difficult for the smaller operators to convert their legal equality of access to the public domain into actual economic equality.

The management of all the minerals in all the Federal lands should be in the experienced mineral agencies in Interior, rather than in several separate Federal Departments. Certain changes in the mineral leasing laws should be considered by the Congress. In Utah and Colorado are large deposits of native bituminous and asphalt-impregnated rock which are now unavailable for exploitation under the mining laws and under the mineral leasing laws. They should be made available, by grouping them with the oil shale provisions of the leasing laws, and may well supply badly needed petroleum resources. The limitation on coal leases of 5,120 acres in any one State should be reconsidered by the Congress. Much of the work on the public domain is under heavy cover, in relatively inaccessible areas, and will inevitably involve high mining costs. Larger acreage will certainly be needed to induce development, and development may be essential whenever we begin pulling on our coal as a source of liquid oil.

Additional prospecting for potash is needed. Present regulations which control the acreage available for prospecting should be reviewed so as to make available a larger area for prospecting without necessarily increasing the acreage available for lease. In the summer of 1946 the Congress increased the acreage which may be held under lease for oil and gas from 7,680 to 15,360 acres. Lessees were permitted to hold, without acreage charge, options for 100,000 acres in each State for geophysical and geologic exploration. Unitization of oil and gas areas is to be encouraged. Rentals are to be maintained to reduce the speculative element, but during production a royalty payment is substituted.

The Department's conviction that metallic minerals on the public domain as well as oil, coal, and potash should be leased rather than be taken over in fee simple has for some years met the opposition of the mining industry. The mineral and land agencies of the Department believe that the public domain is public property and that the national mineral situation is serious enough to demand that some supervision be exercised over the timing of mineral production. They also believe that some royalty should be paid into the public treasury on wealth located on and produced from the public domain. The industry generally believes that the hazards of prospecting and costs of extraction are already sufficiently high, and that the addition of payments on production is one straw too many, and holds back development. Some plan that would allow a basic net income after all costs and taxes and would provide for graduated royalties thereafter, might make the leasing proposal for minerals more acceptable to those small operators who would settle for a reasonable income instead of a killing.

These five parts make up a sound program for this part of the land. Most of them call for some national investment in order to secure later revenue or to prevent present and later damage, or both. They are based on the experience that the days of getting something for nothing out of the public domain are over. Fires and erosion have to be prevented if we are going to have trees, sage, and water without floods.

A sound rehabilitation program for all the Interior lands in the continental United States, including those without people, would run in the neighborhood of $300,000,000.

Our Parks

For 30 years it has been the job of the National Park Service to provide for enjoyment of the national parks and monuments and, while doing so, to safeguard "the scenery, the natural and historic objects and the wildlife therein" for the enjoyment of future generations. The estate it manages contains some 20,500,000 acres of land and water.

Before the war, in the travel year 1941, the National Park System had a record attendance of more than 21,000,000, and that record is certain to be surpassed in this first postwar year. Extension of the practice of paid vacations for industrial workers may be expected to add steadily to the number of those who enjoy that part of our natural and historic heritage that is being maintained for them and for future generations.

It is not always easy to defend the park system from invasion by those who wish to profit from the resources it contains. As the remaining merchantable forests dwindle outside, the loggers cast about for excuses to open up the forests in the parks and convert them into saw logs. The stockmen rest envious eyes on the forage of the parks and monuments, while the grazing that survives in them from the days before they were established approaches—but very slowly—the goal of ultimate elimination. The Department and the Park Service alike are concerned over the possibility of unnecessary and unjustified encroachment upon and damage to park areas by some of the many Federal water control projects now in the planning stages.

Within many of our parks there are numerous tracts of privately owned land and it is these private lands, or lands which belong to the States, which offer one of the most serious impediments, not only to adequate conservation measures, but to sound administration and development. The past year has been replete with instances of the menace inherent in such mixed ownership. A proposed sale of Southern Pacific Railway lands in Joshua Tree National Monument would have resulted in disaster to one of the finest portions of the monument; and it is to the credit of the railroad's board of directors that their lands have been withdrawn from sale so that exchanges, or other means of acquiring them, may be undertaken. One hundred thousand feet of beautiful pine timber was cut on private lands in Glacier National Park; and there is the constant threat of the sale of a large block of State-owned timber in the same park, though the State authorities are sincerely anxious to work out some means of assuring its preservation.

A request for $350,000 to be expended on the purchase of some of the most needed of these non-Federal lands was made to the Bureau of the Budget and was approved by the President, but neither the House of Representatives nor the Senate approved it. Opposition to further Federal land acquisition, with the consequent loss of taxes to local units of government, was the principal reason. It demonstrated again the need of legislation that would permit the apportionment of a part of the earnings of the National Park System to the States for distribution to the counties in which the areas are situated. The necessity of a continuing program, on an adequate scale, of acquiring these inholdings is beyond dispute. The longer it is delayed, the more expensive it will be and the more valuable resources will be irrevocably lost.

A cardinal principle in the National Park Service's planning for public use and enjoyment is that developments in the parks and monuments shall be limited to those needed to accommodate the public and to permit visitors to obtain the fullest measure of enjoyment of those features that give distinction to the areas. A corollary is that these developments shall intrude as little as possible upon the natural scene, particularly if it be one of extraordinary quality. Admittedly, certain developments now to be found in the park system violate these principles; most of them date back in their beginnings to the period before the creation of the Service. However, they represent an investment still valuable in meeting the requirements of the public; consequently, their ultimate elimination, and replacement in more suitable locations, is bound to be a slow process, though the objective is one to be kept constantly in mind.

Just as it is not always easy to defend the parks against invasion, so it is not always simple to make them serve adequately the purposes for which they were etablished. During the war, equipment and facilities, for Government and concessioner alike, deteriorated due to lack of funds and manpower. With the resumption of peace-time operations, eating, sleeping and other facilities have been overcrowded. With only a few exceptions, these facilities are provided by concessioners who operate under contract with the Government and, for the system as a whole, they are far from sufficient. Additional hotels, lodges, cabins and eating places must be provided to care for all but the extreme peak loads, and of kinds that will enable those of moderate means to enjoy their great possessions, though it will doubtless require the devotion of more space to such developments. The alternative is a degree of crowding of existing facilities, already frequent in several of the major parks, that seriously impairs their capacity to provide enjoyment.

Convinced that it would make possible an improvement in service to the public, it is the approved departmental policy to work toward Government ownership of all facilities in the parks, and the operation of them for use by visitors through contracts with nonprofit distributing corporations or with private enterprises for periods of reasonable length, with careful regulation and periodic review of these contracts to determine that they are in the interest of the Government and the public, and are fair to the concessioners.

It should be obvious that the concessions exist for the benefit of the parks, and not the parks for the benefit of the concessions. By this is meant that the provision of accommodations, eating places, transportation and other public services is a means to an end. The concessioners are in the parks for the sole purpose of providing service to the public and not because the parks are fruitful places in which to do business. The services are limited to those which the visitor has a right to expect in a national park. The concessioners, under their contracts, are serving the people no less than the ranger forces, the naturalists, or anyone else, in fulfilling the purposes of the national parks.

The policies of development and management are the outgrowth of years of experience in protecting the park areas and making them permently available for human enjoyment in unspoiled condition. All these, it is believed, have proved their soundness, and are generally accepted by the people who visit the parks as being in the public interest. Not change in these policies, but provision of the means of making them more fully effective, is what is needed to make the parks more useful to the public.

The National Park Service well knows that to change the basic policies governing the national parks might provide within them a few more "recreational areas." However, such changes would lead to undue and unnecessary impairment of natural conditions in areas that were created to preserve outstanding remnants of North America's primeval wilderness for the enjoyment and inspiration of ourselves and future generations. These would increasingly become centers for kinds of outdoor activity that are already being provided for elsewhere, or that can more appropriately be provided on lands of lesser caliber.

Another phase of park management that presents a difficult problem is that of winter use. Mount Rainier, Olympic, Rocky Mountain, Glacier, Yellowstone, Sequoia, Yosemite, Lassen Volcanic, and others put on a wholly different appearance, and one certainly no less beautiful, with the coming of winter's snows. If it is possible to do so without an expense out of proportion to the advantages to be gained, the public should be encouraged to visit and enjoy them in winter and to take advantage of the opportunities they offer for healthful enjoyment of the out of doors at a time of year when too many people spend too much time indoors.

However, during the winter months schools and colleges are in session and relatively few persons take their vacations then; consequently winter visitation tends to take the form of week-end peak loads, with comparatively few visitors during 5 days of the week. It is easy to see what difficulties in the operation of public accommodations these facts involve. Added to this is the heavy expense of keeping open the roads which lead to such places as Paradise Valley in Mount Rainier National Park. Last winter most such roads had to remain closed because the Service simply did not have the funds to open them. At Mount Rainier, a special supplementary appropriation made it possible, though under extremely difficult conditions, to open the road to Paradise. At Yosemite, regular funds were barely sufficient for keeping open the road to the Badger Pass ski area. How far the Government should go in subsidy of this important type of park use, is one of the problems worthy of much more study and analysis.

Imposing though attendance figures for the national park system may be, only a tiny fraction of the more than 140,000,000 Americans who own the parks have the time and the means of really knowing their parks well at first hand, or ever will. Yet they exist for the enjoyment of the people. Even those Americans whose opportunities for first-hand enjoyment of these extraordinary properties is limited, have reason to take pride in the fact that they possess them. But if they are to provide the fullest possible measure of enjoyment, they must be taken to those who cannot get to them. An obligation rests upon the Federal Government to take advantage of the exciting and effective techniques of color photography which have been developed during the past decade and to see to it that there are ample opportunities for every school child and every adult, if only through effective visual presentation, to enjoy the beauty of the parks and to grasp the significance of the historic and prehistoric places and objects that are safeguarded in the park system, through effective visual presentation.

That task is a challenge. In its accomplishment, there are opportunities for many persons and many organizations to participate, and they should be made aware that they exist. But it is primarily a responsibility of the Government itself, which should be recognized and given the comparatively small financial support which is required if it is to be met in a satisfactory manner.

The Fish in Our Future

Perhaps the greatest untapped fishery resource in the world, and one which could be made available to American enterprise if it were fully explored, is the fish supply of the Central Pacific and particularly the tunas which, pound for pound, are the most valuable of sea fishes. The tuna fishery of the Pacific coast from Washington on the north to the Galapagos Islands on the south has grown since 1915 into one of the great sea fisheries. In the Western Pacific the Japanese tuna industry has shown comparable development. Japan's attempt to explore and utilize the tuna resources of the mandated areas was effectively stopped by the war. The extent of these resources in the Central Pacific has never been measured. Hence their development presents a virgin field.

The plans for the rehabilitation of the fishing industry in the Philippines, including the exploration and assessment of offshore fishery resources, form an important link in this program. If pending legislation in Congress for cooperative fishery investigations and development in the Territory of Hawaii is enacted, this crossroads of the Pacific will provide an additional field base and will serve as another link in the developing research program. The final step will be the organization and conduct of tuna investigations in the eastern temperate Pacific and in the equatorial regions coordinating these initial efforts. With the realization of these plans, which include the fuller utilization of the fishery resources fringing the Gulf of Alaska and in the Bering Sea, the food resources of the Nation will be expanded materially.

For the next 2 years, at least, efforts will be made to increase the salmon stocks in Alaskan waters by surveying the coastal spawning streams and by removing in several hundreds of them, obstacles or complete barriers to fish migration which prevent full utilization of otherwise suitable spawning areas. Such barriers to migration as log jams, low falls, and other obstructions will be removed and, where economically feasible, fishways will be constructed, thus opening up miles of additional spawning area. If the available spawning grounds can be increased by 10 percent and the salmon stocks increase proportionately, the expenditure of a few hundred thousand dollars now will add more than 5 million dollars to the commercial fisheries of the Territory.

Meanwhile, more scientific data are necessary by which to improve the accuracy of determining optimum catches and escapements, and to formulate regulations for achieving a proper balance between catch and escapement. Of the counting weirs that are necessary in about 40 representative spawning streams in Alaska, funds are available for installing only 7. Our law enforcement facilities must also be expanded in accomplishing a more effective management program. Fast patrol boats and planes are badly needed to cover 10,000 miles of Alaska coast line.

The fishing industry was more or less dislocated by war-time conditions. Owing to shortages of labor, equipment and materials, and to depressed catches of some species, the production of canned fishery products decreased from 1941 to 1945. It has still not reached pre-war levels, and is insufficient to meet domestic demand. At the same time, under the stimulus of high prices and the relative scarcity of other protein foods, the production of fresh and frozen fish increased, and the frozen fishery industry expanded considerably. During the war period, the demand for these products was almost unlimited. But this demand was transitory, for the war's end released to the public competing products like meat and imported frozen fish; so that by the summer of 1946, holdings of frozen fish in cold storage warehouses were higher than they had ever been in any previous summer. Meanwhile, the production of fish meal and oil was depressed during the war in favor of canned goods, and as a result, supplies are far below current agricultural needs.

More serious than any of these effects, however, was a general decline in the quality of fishery products in many places where the demand was keen enough to result in relaxation of standards. The consequence of this is that imported fish is frequently superior to that produced domestically and can compete successfully with it.

These problems of the fishery industries are very much the concern of the Fish and Wildlife Service, for the full and proper use of a resource is an important phase of the conservation of it. We believe that solution of the industry's problems and readjustment to a peacetime economy can be most quickly achieved by raising the standards of quality and by increasing the efficiency and economy of operation. This is fundamental to enlarging the market. Consequently the Fish and Wildlife Service will continue and intensify its research into methods of improving fishery products and developing new ones. For the first time in 1946 it has the educational facilities for demonstrating to members of the industry—fishermen, processors, and dealers—methods of getting the most and the best out of their raw materials. It will make readily available the most advanced methods of fishing, processing, shipping and distribution.

As the products improve, another program of the Fish and Wildlife Service is directed toward enlarging the market for them. This is being accomplished by educating the public to appreciate the nutrient value and edibility of their fishery resources.

Among the various influences which have been brought to bear on fish and wildlife resources during recent years, none is so far reaching as the water utilization program. This involves projects on rivers to provide irrigation, navigation, hydroelectric power, flood control or other benefits. It also involves the construction of dams, locks, levees, and other structures which disturb to some degree the status of fish and wildlife in and around the project areas. Because some of these will occupy the habitats of some of our most important native food and game animals, the Fish and Wildlife Service has established a staff of scientists who work with the Bureau of Reclamation and the Corps of Engineers to obviate or minimize damage to these resources, or to take full advantage of any facilities that might serve to increase them.

This job is not a simple one. The river bottomlands are generally the areas most prolific of wildlife. They are frequented by migratory waterfowl and many kinds of upland game, especially during the winter season. If adequate measures were not taken in advance, a series of reservoirs in a valley could destroy the entire supply of winter cover on which deer and certain game birds depend, and thus eliminate the animals themselves.

Certain projects proposed in the comprehensive plan for the development of the Missouri River Basin will have a deleterious effect on important waterfowl nesting refuges in Montana and the Dakotas. These areas will have to be duplicated as nearly as possible with areas of equal value, improvements, and water facilities for wildlife needs.

Meanwhile, the Fish and Wildlife Service is working to develop methods of utilizing the structures that are being built. Reservoirs are viewed from the standpoint of their future use for the production of sport and commercial fish, as State or Federal migratory waterfowl refuges, and as public shooting grounds. We are working to increase fish and wildlife habitats through practical modification in the structure and operation of reservoirs. Thus projects can often be changed from the debit to the credit side of the evaluation ledger, from the standpoint of animal resources. It is not enough to insure maximum production of fish and game by incorporating sound biological considerations in the development plans. These resources must be managed after construction and impoundment. Only this combination—suitable habitat and good husbandry—will produce and sustain fish and game crops on the land and water areas affected by the national river development program.

Wildlife Conservation

The size of the waterfowl crop depends on many factors, of which the length of the shooting season and the bag limit are only two. The many vicissitudes of nature are of great importance. In 1945 and again in 1946, droughts dried up vast areas of the Canadian prairie provinces and reduced or destroyed the breeding value of about 45,000 square miles of key territory. In addition rains and a spring blizzard in New Brunswick and Nova Scotia destroyed many ducks. As a result of these factors, fewer wildfowl were produced in 1945 than hunters shot the following season; and the total wildfowl supply declined to about 64 percent of what it had been in 1944.

The future supply of waterfowl depends on the kind of management we give it. While barren years like the last two will eventually be offset by fertile ones, the number of hunters will continue to increase. This is an important factor in the problem of managing the waterfowl resources, and will put a premium on our having an accurate estimate of the size of the harvest. It will also put a premium on the coverage by our law enforcement officers. To accomplish this estimate and coverage, we must have a corps of at least 150 well-trained and fully equipped United States game management agents, who will work in close cooperation with conservation officers of the various States.

For migratory waterfowl, we apply two principal and essential conservation techniques: First, we limit the number of birds that hunters may harvest each year; second, we maintain a nation-wide system of refuges, which have been strategically located to give the birds rest, food, and shelter during their long seasonal voyages, and protection on their breeding grounds. The value of this system continues to grow each year as the acreage of water has become stabilized to assure a steady optimum production of aquatic food and plants needed for nesting. The continued orderly development of the refuge system is an essential feature of our design for waterfowl restoration and maintenance.

What is true of waterfowl is true, on the whole, of other game birds. For example, the ring-necked pheasant has suffered a serious decline in abundance over much of its range, and especially in the Midwest. This is the consequence of a series of several years of weather unfavorable to nesting and brooding. For the same reason, the bobwhite quail population has been sharply reduced in parts of the northern limits of its range; and the ruffed grouse too is at a low ebb of abundance.

The status of big game is generally favorable. The diversion of hunters to military duty or to wartime industrial occupations, the reduction in the supply of sporting arms and ammunition, and restrictions on travel, all helped to conserve and even restore game. But war conditions were not everywhere without ill effects on game. Hunting pressure tended to be intensified and concentrated near large centers of population, war industries, and military establishments. Some game ranges which were included in maneuver areas and artillery or aerial bombing ranges suffered severe damage. In such areas, the recovery of the vegetative cover to their prewar carrying capacities, and the restoration of the wildlife populations will be the work of several years. Numerous areas acquired by the military services as temporary bases are, or will be subject to disposition. Many could be developed into excellent wildlife refuges or management areas.

Hopes for prompt renewal of more effective predator and rodent control work after the war were dispelled by delays in reconversion, which hampered acquisition of badly needed equipment. A little progress was made, however, by increased use of recently developed control methods. Several of these, including the famous rodenticide, Compound 1080, are still in the trial stage, but will probably be released for carefully controlled operational use in the near future.

Basic Indian Problems

The basic Indian problem confronting the Government is that of a low-income group operating on a small resource base, under a peculiar combination of independence, dependence, and separation. In many ways this basic problem and the many others growing out of it are similar to those of the peoples living in underdeveloped areas throughout the world. These peoples do not want the low standards of health and education that go with agricultural poverty. They want a better land base, better techniques of resource development, more industrialization—everything that will give them a chance to participate in the economic progress of the world; or, for the Indians, an opportunity to share in the rising standard of living of the Nation as a whole.

During the last decade, the Indians have made considerable progress toward the goals of self-government and economic independence. As a nucleus they had only the meager land base left to them after almost half a century of the allotment policy, under which the Government had allowed and encouraged the allotment of tribal lands to individuals and the subsequent alienation of some 80,000,000 acres of Indian land.

Lost in this manner was much of the better land which they had retained under various treaties with the United States.

Beginning with the Indian Reorganization Act of 1934, the national policy changed to one of protecting the remaining tribal resources, replenishing the resources base on which to build economic independence, and reestablishing the authority of tribal councils. The new policy has been implemented through purchase of additional lands, through better management of agricultural, range, and forest lands, and through the establishment of various industrial enterprises to utilize tribal resources, such as timber and minerals. Coincident with these economic phases of the program were the equally important programs in the fields of health, education, and tribal self-government. For little progress could have been made by a people in poor health with a high rate of illiteracy.

While there is ample evidence on all reservations today of the strides which have been made in the economic, health, and education fields, there is almost equally plentiful evidence of the need for the continuation and, indeed, the expansion of the various programs, if the Indian is to assume his rightful place in the Nation. The most urgent aspects of the problem and the steps being taken by the Indians and the Indian Service to alleviate the situation are briefly summarized in the following paragraphs.

Underlying many of the Indians' problems is a generally low health level which shows up clearly in the high rate of infant mortality. While only 2 in every 50 babies in the Nation as a whole die in the first year of life, 2 or 3 in every 10 Indian babies are thus doomed.

The correlation between low income and poor health is aggravated in the case of the Indian population by its historic lack of resistance to tuberculosis. Although the fight against this disease among Indians is never relaxed and a high rate of protection has been achieved during the past 10 years through persistent experimentation with antituberculosis vaccine (BCG) the incidence of the disease itself is still five times higher among the Indians than among the people of the United States as a whole. In Alaska where the Indian tuberculosis rate is even higher than that in the United States, the Indian Service has recently acquired the Sitka Naval Base which will be converted into a 200-bed tuberculosis sanitarium and a boarding school for 600 pupils.

Many other diseases, particularly those of the digestive tract, also take a high toll of life. The incidence of trachoma, however, formerly a prevalent disease among the Indians, has been greatly reduced, largely through the use of sulfanilamide, the effectiveness of which as a remedy for this disease was discovered by the Indian Service medical staff.

The Indian Service health program has been seriously handicapped during the war years by a shortage of doctors and nurses to staff the 76 hospitals and sanitaria and the field medical positions. Even after large-scale demobilization by the armed forces, many doctors and nurses have failed to return to the Indian Service because only limited tenure could be obtained. Establishment of civil-service registers in these fields and permanent appointments made therefrom should help to alleviate the shortage in trained personnel.

The Indian Service is confronted with many problems of education—both in the narrow sense of school rooms for children and in the broader sense of helping the tribe to make the optimum adjustment to its particular circumstances. The shortage of physical facilities is most acute on the Navajo Reservation, where there are schoolrooms for only 6,000 children, or for only 30 percent of the 20,000 children of school age. On that reservation the problem includes finding the proper compromise between day schools, which are best from the educational viewpoint, and boarding schools, which are more practical because of the long distances children must travel to school and the lack of all-weather roads. More than ever before, however, the Navajo Indians themselves are pressing for more education and are cooperating with the Indian Service in attacking the problem. They have not only consented to, but encouraged, the sending of several hundred children, aged 12 to 14, to schools in Albuquerque, N. Mex., Riverside, Calif., and even to Chilocco, Okla., where special courses have been designed to teach English and elementary subjects simultaneously.

Although expanding its facilities in areas like the Navajo where no alternative school services can be secured, the Indian Service follows the definite policy of utilizing State schools wherever feasible, paying tuition for the children under various types of contracts. Additional contracts are constantly being arranged.

Under education in the broader sense, many of the Indians are faced with the necessity of adjusting their economic, social, and spiritual ways to the fast tempo of modern American life. The transition from the nomadic hunting economy which died suddenly when the buffalo had been killed off and from the primitive subsistence agriculture which was disrupted when non-Indians put up fences and took most of the good land, has not been completed. One result of this situation is that many individuals have not learned how to utilize to best advantage the returns which they have earned in their new society. Thus there are tribes where the average family income compares favorably with that in a similar non-Indian community but where the Indian housing and health standards are definitely inferior to those of the non-Indian. It is, therefore, the task of the Indian Service to help the Indians acquire the knowledge, skills, and motivation which they need in completing the difficult adjustments in their living and thinking habits.

There is today a considerable movement of Indians to and from the reservations. During the war many went into the armed forces. Many others found employment opportunities in war work outside the reservations. The contrast between the high reward for such wage work and the return which they had received on the reservation was great. Although some Indians have remained away from their homes, a majority have returned either because their war jobs were terminated or because they preferred reservation life. Some returned home for a brief period and then departed again to seek further wage work. The present picture, indeed, is far from clear, and constitutes a real problem for the Indian Service in its attempt to promote Indian welfare in general. For while the Service encourages off-reservation employment under good conditions as a partial antidote to the inadequate resource base of many tribes, it also foresees the danger of industrial or rural slums where adequate housing and health standards are not maintained. It is consequently the policy of the Indian Service to work closely with State and local organizations in preventing the growth of such slums. In this connection it is recognized that off-reservation employment opportunities will vary with the economic state of the Nation, with an inevitable movement toward such employment when jobs are plentiful and wages high. It is nevertheless hoped that the number of permanent migratory laborers can be held to a minimum. Indians who settle either on or off the reservation should obtain greater financial security as well as better education and medical facilities for their families.

One possible remedy for the inadequate resource base possessed by many of the tribes would be the continuation of the land acquisition program. This course of action is, in fact, being carried out by the Indian Service, although, for reasons stated below, on a much smaller scale than during the years preceding World War II. The basic obstacle to large-scale land purchase by or for the Indians is the ever-increasing demand for land of all kinds by the expanding population of the Nation. This is reflected by the increase in the price of land during the war years. In the 17 States where most of the Indians are located, the price of farm lands went up by 54 percent and the price of range lands by 75 to 300 percent between 1940 and 1945. Another obstacle to a land acquisition program is the opposition to Indian purchases as indicated by the limitation in the present appropriation act which prohibits the use of either tribal or Federal funds for the purchase of lands outside reservations in several Western States. There is equally strong competition for every drop of irrigation water which is needed to grow crops in most parts of the West. Consequently, there are instances where the Indians own large acreages of irrigable land which cannot be fully utilized, at least under current water policies, because of an insufficient supply of water. An important task of the Indian Service is the protection of Indian water rights in several key areas including the Colorado River Basin.

Although present land areas are definitely inadequate for some of the tribes, there are many reservations where the program should be better utilization of the existing acreage rather than the acquisition of more land. Here the Indian Service must continue to help the Indians improve their agricultural and stock raising technique. This problem is related to that of general adjustment mentioned above.

One method of improving land utilization is the consolidation into economically usable units of small plots of land which are the result of divided inheritance. One hopeful example of such consolidation is the program on the Rosebud Reservation in South Dakota where more than 20,000 acres of small scattered parcels of land were exchanged by the individual owners for shares in the Tribal Land Enterprise, which manages 60,000 acres and pays dividends on its shares.

Another possible method of compensating for the inadequate resource base is the diversification of the economy of some of the Indians. Industrialization, for example, would lessen the present overload on certain reservations. A study is now being made of the Navajo Reservation to determine what industrial possibilities exist for Indian production of raw materials, semifinished and finished goods. The Navajo sawmill now ships all its product off the reservation as timber, although it is quite possible that the Indians could profitably convert at least a portion of it into wood products such as sash and doors. Indians employed in such work would no longer depend upon the overtaxed agricultural and stock raising resources of the reservation. Similar possibilities are being investigated on many reservations not only in the industrial field but also in mining, arts and crafts, and tourism.

It is the belief of those in the Indian Service responsible for helping the Indians plan for the future that the maximum benefits will be gained in the immediate future through a combination of improving the utilization of their present lands, acquiring additional lands where available, and diversifying their economy wherever possible.

Wherever plans or programs affecting Indians are formulated, there is always to be considered the net annual increase in the Indian population of the country. The group which now numbers approximately 400,000 is increasing at a rate of 1.2 percent annually, compared to a national rate of 0.74 percent. This increase has been made in spite of the high infant mortality rate and disease rates mentioned previously.

An important aspect of Indian Service work in Alaska is the clarification of the status of Native land in the Territory. There are a few Native reservations similar to Indian Reservations in the United States, but most of the natives live in villages where title to the land has never been formalized. During the last half century the natives have been gradually forced out of some fishing and hunting areas which they and their ancestors have used since time immemorial. As the natives are largely dependent upon their land and water resources, the Indi Service is helping them in their attempt to hold or regain those lan to which their claims of possessory rights are justified. The settleme of the land status will be advantageous to both the natives and no natives of the Territory.

A major problem facing the Indian Service today is that of publ relations in the broadest sense. In order that the Indians may be a cepted as American citizens, in fact as they were by law in 1924, the must be a much wider knowledge of the facts on the part of the Amer can public. Indians will not be fully accepted while so many people a under the false impression that Indians are forced to live on reservation There will likewise be no equality for Indians when they are barre from stores and restaurants in communities near their homes and whe they are not hired on the same basis of non-Indians. The States c Arizona and New Mexico still bar Indians from voting, although it hoped that cases now before the courts will remedy this unfortunat situation in the near future.

In order to deal more effectively with the complex problems outline above as well as many others, the Indian Service has made severa significant changes in its methods of administration. Basically thes changes are designed to simplify Indian Service procedures, many c which had become extremely complicated since the Bureau was established in 1824. Many questions of local interest only were required b law to be referred to Washington for an answer. As a remedy for thi situation, the Secretary of the Interior, under authority of the act o August 8, 1946, has delegated to the Commissioner, and the Commissioner, in turn, to lesser officials various powers and duties originall assigned by Congress to the Secretary of the Interior. A second ste toward simplification was the establishment of five district offices i Minneapolis, Minn.; Billings, Mont.; Portland, Oreg.; Phoenix, Ariz. and Oklahoma City, Okla. To the directors of these offices has bee delegated the authority to make many of the decisions which woul formerly have been referred to the central office.

Another event of great importance was the enactment by Congress of the Indian Claims Commission Act, in the summer of 1946. The Commission of three members, created by this act, will hear, during the next 5 years, all claims of Indian tribes against the United States. Within 10 years from the date of passage of the act, the Commission will pass upon the validity of each claim and make recommendations to Congress as to its settlement. The creation of this Commission constitutes a major step toward the solution of the complex problem of Indian claims which has for many years clouded the relationship between the Government and numerous Indian tribes.

Problem Areas

The Department of the Interior is interested in several problem areas. These include such differing localities as Alaska, where a small population and large prospective resources have not yet created an expanding economy, and Puerto Rico, where a very large population is living on a very low level under a peculiarly one-sided agricultural economy. They include areas of devastation, such as the Rio Grande Valley, and rich areas such as the sugar and pineapple lands of Hawaii where there is some danger that high fertility may be lost under the impact of mechanization. The underdeveloped areas resemble some problem areas of the mainland, such as that part of the Missouri Basin which has been losing population. Parts of the Southwest and of Hawaii still require an industrial balance for the agricultural bull wheel of their economy.

In all of these areas the Department has the same type of concern for resource development and a higher standard of living that the Department of State and the United Nations have for the underdeveloped nations beyond our borders. The Interior Department's interest is more direct, because these areas are part of the United States. Alaska's development carries with it many of the hopes of the whole Pacific Northwest. Puerto Rico's development, for better or worse, exemplifies to all the Carribbean countries and many other Latin-American countries the net product of the American economic and political system. Our influence in those countries, including their supply of raw materials to us and their purchase of our products, is affected by their judgment of our conduct in Puerto Rico.

Alaska is a self-governing territory, with a Governor appointed by the President. Its present population is approximately 90,000, including some 33,000 Native Indians, Aleuts, and Eskimos. Its industrial development has been confined to mining (largely gold), some lumbering and a large fishing and canning industry. Gold mining was almost completely curtailed during the war, while lumbering was considerably expanded. There are good prospects for all of these industries. The potential pulp and paper industry needs hydroelectric power to get started on the large coastal forests. The potential power sites that would best serve this industry and also the Alaskan communities are reasonably well known. The fishing industry can expect to increase as it goes into the taking of crabs and various ground-feeding fish that have so far been neglected. The mining industry is giving increased attention to the less valuable but industrially more important minerals, such as mercury, chromite, antimony, and limestone, as well as the local demand for coal.

The possibility of a large tourist business has excited the interest of many Alaskans. The road system is not wide flung but is being expanded. Ship rates for passengers and freight transportation to Alaska, as well as rail and air rates within the Territory are high. Because o the limited passenger facilities on the coastwise steamships serving th Territory, the wonderful scenery and recreational opportunities of Alask are not bringing the number of vacationists that were attracted befor the war. There is no other way for tourists to reach Alaska. The establishment of scheduled air services and the construction of the Alask Highway will open new routes of travel capable of transporting a fa larger volume of vacationists than the steamship lines were ever equippe to handle. The urgent present need is for lodges, hotels, and recreationa centers to be developed within Alaska to accommodate the great numbe of tourists who will take advantage of Alaska's vacation attractions as soon as they can find accommodations. Steamship facilities, too, need to be expanded and improved in order to provide space for cruise passengers and to build the Alaska tourist industry to the limit of its possibilities.

The prospect for a large influx of settlers now appears to wait on an increase in industrial opportunities, lower living costs, opening up of public lands which were withdrawn for one purpose or another during the war, and materials for housing. The agricultural opportunities seem to be dependent on a great deal of preliminary land clearing or drainage work. The disputed attempt of the 1930's to establish an agricultural settlement, the Matanuska Valley Farm Colony, proved to be justified by the war. Shipping space for farm products was saved. The Matanuska farmers made large profits. The settlement is now on a going financial basis.

The Division of Territories and Island Possessions in the Department deals with Alaskan problems. It believes that programs for Alaska should be developed cooperatively by the Federal and territorial Governments. Its opinion is that if there were a national economic emergency that required public investment, several hundred million dollars could be spent profitably on public works which would develop the Territory's resources.

Puerto Rico presents the complex of a steadily increasing population with a decreasing standard of living, based essentially on the production of a major crop, sugar, for sale to the United States. Its present population is 2,100,000, 23 times that of all Alaska, and by 1960 another 600,000 persons may be added. The available land for cultivation is limited to a million acres, or about one-half acre per person now. This will be about one-third acre in 1960. It compares with 4 acres of arable land per person in the continental United States. Puerto Rico's main crop, sugar for sale on the mainland, is, of course, subject to the fluctuation of sugar prices and quotas. It is also subject to the cataclysmic potentialities of synthetic sugar substitutes. The result is hat the Puerto Ricans import $37,000,000 worth of food. The manufacturing opportunities have as yet been so little developed that the island imports $160,000,000 of other merchandise and commodities annually.

Development of Puerto Rican industries has been attempted in recent years. Cement, glass, boxboard, clay products, and shoe manufacturing plants have been established, but only 14 percent of the working population is employed in industry at present. Its income, while low, is still considerably higher than the income of the farming population. The average family income at present is about $350 a year, which is still lower than that of any one of the United States. The economic future of the island is linked with its political future. Tariffs, subsidies, credit aids, freight rates, are all tied up together with its political position. While the Governor and certain other officials of the executive and judicial branches of the insular government are appointed by the President, the legislative branch, consisting of a House and a Senate, is popularly elected.

The Division of Territories and Island Possessions believes that development programs must come principally from the island government. The Insular Government of Puerto Rico is aware of its needs and has developed an outstanding long range planning program as a guide to raising the substandard conditions in health and school facilities, sanitation and water supply, roads, etc. This plan shows that $344,000,000 should be expended to bring conditions up to a minimum decent standard. Of this amount, the insular government plans to provide about $55,000,000 during the next 6 years.

It is estimated that at least 8,000 new houses should be provided annually to take care of its population increase, and over 300,000 houses that are now substandard should be replaced at the rate of 15,000 per year for the next 20 years to eliminate the serious urban and rural slum conditions now existing.

The Virgin Islands, although much smaller, having a population of about 25,000, present similar economic and social conditions to those of Puerto Rico.

Here, too, a lack of natural resources is a limiting factor to industrial expansion, and agricultural development is precarious. It appears likely, however, to some students, that the tourist trade can be developed to a point where the existing deplorable conditions can be raised to a decent standard.

From the resource viewpoint, Hawaii has done far better than Alaska or Puerto Rico. However, less than one-tenth of the total land area is reasonably suitable for agricultural use, and about one-third is usable pasturage. The ownership of the land is highly concentrated. Increased mechanization in connection with the harvesting of sugar can which was resorted to by the plantations as a result of labor shortage and increased wage rates, has accelerated the depletion of soil fertility Removal of the topsoil by "grab loading" and erosion seems to be a inevitable result of the replacement of hand planting and hand harvesting by the use of heavy equipment. The pasture lands also suffere from wartime overgrazing.

The war also brought with it new insect pests that are an additiona menace to plants and fruit trees. The water situation became acut both in the cities and in some of the rural areas. In Honolulu wate consumption doubled between 1940 and 1945. Legislation makin all ground waters public property is being considered. Reclamatio projects are being studied, with a view to bringing additional lands int cultivation, especially for the growing of fruits and vegetables.

The Department of Agriculture and the Territory are undertaking a project to protect cropland by cover crops and erosion controls and to plant appropriate grasses on the ranges. Studies of offshore fishing possibilities are being strongly urged by the Territory.

The increasing population in Hawaii presses heavily on the land, creating housing and land redistribution problems of some magnitude. The Division of Territories and Island Possessions recommends effective long-range planning to overcome these problems, especially a thorough survey of land utilization possibilities.

Far more severe than the resource problems of Hawaii are those of the Rio Grande Basin. Extending 1,800 miles in length and including 185,000 square miles in Colorado, New Mexico, Texas, and the Republic of Mexico, this river valley presents an outstanding case where a high degree of coordination is needed to deal with the development, use and conservation of the natural resources. This basin, with a population of nearly a million people in the United States portion, which is predominantly dependent on irrigated agriculture, range livestock, mining, and tourist trade, is facing ruin unless the destruction of the land and water resources, caused principally by erosion and sedimentation now going on apace is reversed and corrected.

The threat to this region comes from the neglect and break-down of the vegetation and soil on the watershed under the strain during the past 75 years, of continued and severe grazing and other land-wearing activities of man, and rodent infestation coupled with recurrent drought. In this semiarid section, vegetation has a precarious foothold at best, and the soil, once its protecting mantle of vegetation has been weakened, is highly susceptible to erosion by run-off from rainfall, which is often concentrated in torrential downpours. The soil, loosened from the slopes and valley bottoms of the drainages, is being washed into the main stream and major tributaries where it is clogging channels, conibuting to floods, waterlogging the rich valley agricultural land, and lling the storage reservoirs at an alarming rate. Extensive areas in rigated sections have already become waterlogged and forced out of roduction, and now require new drainage systems, or rehabilitation f old ones. Others lack sufficient water storage and regulation facili-es. Existing irrigation works in some districts require rehabilitation. irtually the entire basin is in urgent need of flood control. Low-cost ydroelectric power is essential to the further development of the re-ources of this region. The entire area lacks adequate recreation and sh and wildlife facilities. Rehabilitation of the grazing lands is es-ential not only to the control of erosion, but also to replace a sound oundation under the range livestock industry.

The situation is the most serious in the New Mexico section of the nain Rio Grande, and its principal tributary, the Pecos River.

There are two major aspects of the basin problem. These are man-gement and related measures to correct and improve the conditions n the watershed lands where the sediment originates, and the con-truction and operation of dams, canals, drainage systems and other levelopments on the main streams and major tributaries to regulate he water supply and impound silt that cannot be withheld on the water-hed or has already reached the main streams. These two features verlap, are interdependent and must necessarily be worked out together in an integrated over-all program for the basin.

The formulation and carrying out of the over-all program necessary to meet the situation is complicated and delayed by many factors. There is a need on the part of the local people to appreciate more fully the gravity of the problem, especially the land-water-people relationship in the area. This relationship is more sensitive to mistreatment and more vital to human welfare in the Southwest than elsewhere in the United States. Divergent views and interests need to be clarified and reconciled. Overlapping jurisdictions—Federal, State, and local—need to be harmonized. It is abundantly clear, however, that if the destructive processes which began scarcely more than 75 years ago (although irrigation was begun by the native people several centuries ago) are not halted and reversed, the present day engineering developments for reclamation, flood control and power works will be short-lived, and much of the whole economy and social structure based on the land and water resources, in a matter of time will be overwhelmed and destroyed.

An elementary need to achieve progress in the solution of the present problem and the further sound economic development of the land, mineral, water and power resources of the Rio Grande Basin, so far as the related Federal activities and responsibilities in the area are concerned, is the establishment on the ground of Government machinery that will result in a coordinated unified approach on the part of all of the Federal agencies involved in the formulation and carrying out of an adequate over-all program. At the present time several Bureaus of the Department of the Interior, several Bureaus of the Department of Agriculture, the Corps of Engineers of the War Department, the Federal Power Commission, and the International Boundary and Water Commission, United States and Mexico, have important functions and responsibilities in the basin to the land, water and other natural resources which need to be harmonized and directed to a common end.

Of equal importance in the Rio Grande basin, as in other river basins of the country, is the provision for participation in any program undertaken in whole or in part by the Federal Government, by State and local governments and other bodies of citizens both in the development and carrying out of any such programs to the end that whatever is accomplished will represent the combined interests of all concerned.

The Department of the Interior is now making a special effort and study to push its plans and meet its responsibilities. It stands ready to cooperate to the limit in the development of machinery that will result in a coordinated approach of all agencies concerned in meeting this most urgent situation in the Rio Grande basin.

Regionalization

During the past years it became evident that efficient administration required the field and area offices of the various departmental agencies to assume more responsibility. Continued concentration in Washington of key technical personnel was found to be undesirable, as well as contrary to the wishes of the Congress, which usually puts limits on the amounts of each appropriation that can be spent in Washington.

Regionalization, in the Department's thinking, means something different from simple decentralization. During the war the National Park Service, the Office of Indian Affairs, and the Fish and Wildlife Service were all located in Chicago. Prior to that, the main office of the Bureau of Reclamation was located in Denver, and the main office of the Grazing Service was in Salt Lake City. That was decentralization in the simple form of administration outside of Washington. However, it was not conducive to the assumption of responsibility by field offices in the river basins or other areas. Regionalization, as the Department understands it, involves putting able men close to the problem with which they are dealing and giving them sufficient authority so that, with technical guidance, they can carry out their duties. It involves the establishment of a local agency which could deal locally with certain types of problems effected by Federal responsibility. It would relocate the focus point of certain Federal powers and functions already in existence so that they would be carried out on the home grounds, instead of being performed in Washington. The creation of a regional development body merely transfers existing Federal authority to the grass roots. It would not replace the Federal agencies performing functions in an area which are clearly a part of a great national program.

The Department has moved slowly in the direction of regionalization of a much less ambitious type than the Secretary's proposal for a regional river basin administration in the Columbia Valley. Within the last few years, the Bureau of Reclamation has established seven regions. The Office of Indian Affairs has recently created five field districts. The district manager in charge of these areas receives a large delegation of powers from the Commissioner and is directly responsible to him. It is believed that decisions can be made more rapidly in this way. The Bonneville Power Administration, with its headquarters in Portland, has been a regional power marketing agency since its inception, as has been the Southwestern Power Administration, whose headquarters are in Tulsa. Plans are under way to propose to the Congress the establishment of a similar power marketing agency in the Southeast. Other Bureaus of the Department also have regional organizations or are considering their establishment.

A further move in this direction has been made by the establishment of a Missouri River Basin Field Committee, on which field representatives of all the Interior agencies directly concerned with the river basin program plan their work cooperatively. The Committee has prevented some delays and some conflicts. It reports to the Department's Water Resources Committee. In the Columbia River basin a Pacific Northwest Coordination Committee is pulling together the programs of the Interior agencies in that area. The Department is in the process of evaluating the various regional administrative concepts to determine which of them is best suited to the problems facing it.

Emergency Public Investment

The investment in our national plant is usually spread out thinly over the years. This is particularly true of the investment that does not pay for itself directly, but adds to the national wealth, and pays for itself gradually. The Department was asked by the Council of Economic Advisers, which was set up under Public Law 304, how much desirable and needed public investment could be hurried up, and how much money it would cost to get a very large public investment through the study, blueprint and design stage.

The Department's reply to the Council indicated that over any 3-year period of national emergency about 4.2 billion dollars could be spent on useful investment in public plant. The cost of rushing studies and designs to completion over a 12-month period preparatory to any such emergency would average 4.3 percent of the total cost, or about 190 million dollars. The 3-year investment would include large amounts that would be wholly repayable, with interest, such as power, $208,400,000, larger amounts in multiple-purpose projects that might be as much as three-quarters repayable, $2,635,200,000, and other amounts that would produce a less direct return through taxes or fees, $1,356,000,000.

The resource problems and programs outlined here must be met by considered action on the part both of the Congress and the administration. The solution of those problems, and the establishment of a sound and profitable resource base for the Nation, affect the economic life of all its citizens. The individual bureaus and agencies work together on the common problems. The account of their activities makes up part II of this annual report.

PART II

ANNUAL REPORTS OF BUREAUS AND OFFICES OF THE DEPARTMENT OF THE INTERIOR

The Bureau of Reclamation

MICHAEL W. STRAUS, *Commissioner*

WITH the cessation of hostilities in the fall of 1945, the Bureau of Reclamation immediately revised its budget request and in turn it received appropriations by the Congress of approximately 90 million dollars to resume a normal construction program. The Bureau's program during the war years had been definitely curtailed and limited to those projects which were believed by the WPB to be of assistance to the war food program and to such projects as would produce quickly large blocks of electrical energy.

To facilitate the quick resumption of construction activities after wartime restrictions were lifted and to eliminate a considerable amount of time and effort in awarding construction contracts, the Secretary of the Interior delegated to the Commissioner of Reclamation authority to approve change orders and award contracts up to $500,000 in lieu of his previous authorization of $50,000. In turn the Commissioner delegated to the Chief Engineer, to the Director of Supply, and to the Regional Directors authority to award contracts and approve change orders up to $50,000. These delegations of authority assisted in expediting the purchase of materials and equipment and the initiation of construction on the Bureau's multimillion-dollar program.

The resumption of construction work on the Bureau's projects will provide irrigation water for many million acres of arid lands and thereby provide homesteads with unlimited opportunities for the returning veterans and will immediately provide a large number of man-hours of work both for returning veterans and unemployed war workers in jobs extending to factories producing materials and equipment for construction.

The year 1946 marked the beginning of the most extensive production program that has been proposed for the Bureau of Reclamation in any one year since the enactment of the Federal reclamation law in 1902. The construction of dams, pumping plants, canals, siphons, water distribution systems, power plants and transmission lines are included in the well-balanced development of the natural resources of the 17 Western States planned to create in 5 years more than 45,000 family-size irrigated farms on about 4,000,000 acres of productive lands.

TABLE 1.—*Summary of contracts executed in fiscal year 1946*

Nature of contracts	Number of contracts	Amount [1] involved
Cooperative investigations	17	$227, 475. 00
Supplies	196	289, 419. 05
Material	676	8, 840, 311. 71
Equipment	593	3, 420, 978. 58
Miscellaneous services	495	793, 487. 22
Construction work	112	45, 179, 723. 78
Land purchases, including improvements	386	696, 821. 25
Land sales, including improvements	7	21, 317. 00
Leases to the United States	162	195, 976. 53
Leases from the United States	658	430, 128. 95
Compromise of damages	0	0
Rental of Government equipment	112	19, 126. 68
Rental of water	293	237, 847. 09
Sale of surplus electrical energy	35	329, 291. 12
Sale of water rights to towns	0	0
Sale of water rights under the Warren Act	10	106, 959. 90
Sale of water rights within projects	32	113, 714. 10
Adjustment and relief	3	10, 962. 52
Transfer of project operations	0	0
Miscellaneous	137	3, 055, 987. 64
Acquisition of rights-of-way	34	52, 600. 00
Acquisition of water rights	5	27, 000. 00
Interim water service	6	100. 85
Total	4, 019	64, 048, 628. 97

[1] Estimated, in part. Many of the contracts awarded in fiscal year 1946 will be executed in fiscal year 1947.

Missouri Basin Construction Starts

Construction work on the Missouri River Basin project was started to advance the comprehensive over-all program for the complete development of the land and water resources of the arid, semiarid and subhumid areas of this river basin which includes one-sixth of the land surface of continental United States.

During the year 52 irrigation and power projects were in operation. Much of the power output from these projects went to airplane, aluminum, chemical and other industries classified as essential to Allied victory. Approximately 5 million people, amounting to nearly one out of five persons in the West, were served through the Bureau's irrigation, power, and municipal water service made possible by 44 years of construction work on Bureau of Reclamation projects.

Water Conservation and Utilization Progress

Construction activities on eight Water Conservation and Utilization projects were continued or resumed during fiscal year 1946. The Post Falls Unit of the Rathdrum Prairie project, Idaho; the Intake project, Montana; the Newton project, Utah; and the Scofield project, Utah were completed during the year.

The Fallon Unit of the Buffalo Rapids project-second division, Mon-ana; the Mirage Flats project, Nebraska; the Rapid Valley project, South akota; and the Dodson Unit, Milk River project, Montana.

Funds are available for continuation of construction of the Eden, Wyo., nd the Mancos, Colo., projects, but work is dependent on repayment and elated considerations. Work is continuing on the Balmorhea project, exas.

Civilian public service crews, under the Selective Service Program, con-inued work on three Reclamation projects during part of the fiscal year nd helped to relieve to some degree labor shortages, which existed at that ime, in continuing construction and development work. Work by these rews was gradually reduced so that by the end of the year none of these amps was in operation.

Veteran Settlement and Land Development

During the past year, Bureau projects stepped out with tangible accomplishments in making new lands available for settlement to veterans. Public lands on a number of projects have been readied for openings during the fall of 1946, and new private land farms received first irrigation water during the current irrigation season.

The importance of the Reclamation settlement program was recognized by the Congress through increased appropriations in the First Deficiency Act that was passed at the beginning of the calendar year. The projects that will provide new farms for veterans were singled out by the Congress for exceptional increases in appropriations. The same action was taken by the Congress in the regular appropriation act that was passed in June. After extended testimony by Bureau representatives, the Appropriations Committee increased construction funds to provide settlement opportunities.

In keeping with the expanded settlement program, the Bureau is provided with increased facilities for the success of the new farmers. By Order 2195, Secretary Krug provided for increased participation by local communities in the selection of entrymen on public land. A program of land development and settler-assistance was approved by the Commissioner. This program includes testing and leveling the land, roughing in of irrigation facilities and the coordination of all available resources, both within the Bureau and those offered by other agencies. These and other measures bring the Bureau of Reclamation's settlement program to the fore throughout the United States as a practical, effective, and timely program for meeting the desires of qualified veterans to establish themselves on irrigated farms.

Public Land Openings

The cessation of hostilities early in the fiscal year brought a strong revival of interest in land settlement, particularly on the part of war veterans seeking a new start in civilian life. The Washington office alone received more than 3,500 inquiries concerning settlement opportunities during the year, while many thousands more were received by region and project offices.

To meet this demand, the Bureau expedited preparations for the opening of all suitable public lands in 1946 and construction and development work to open other public lands as soon thereafter as possible. Enlarged authority and responsibility in the selection of settlers was delegated to local examining boards. Boards to operate under this order were named on the Tule Lake division of the Klamath project in Oregon and California, the Roza division of the Yakima project in Washington, and the Heart Mountain division of the Shoshone project in Wyoming.

At the close of the year, farm unit layouts were practically completed and drafts of public notices in preparation for land openings on the following projects during the first half of the 1947 fiscal year:

Project	Total irrigable farm	
	Acreage	Units
Klamath project, Tule Lake division	7,527	86
Yakima project, Roza division	1,722	28
Shoshone project, Heart Mountain division	7,720	83
Minidoka project, Gooding division	3,500	44
Owyhee project	150	3
Total	20,619	244

Crop Production

As new projects or divisions are completed and placed in operation this fact is reflected in annual summarizations of the irrigable acreage for which water is available, the acreages that were irrigated, and the crops produced. In 1945 the total irrigable area exceeded 5,000,000 acres for the first time. This figure includes all areas receiving supplemental and surplus project water under the provisions of the Warren Act, as well as special contractors. Gross crop values totaled $435,184,395, or $103.72 per acre, based on the total of 4,195,732 acres in cultivation. This gross value was accompanied by high operating costs, inadequate labor and other uncertain conditions that confronted the farmer and reduced his net profits. On the whole, however, the reclamation farmers enjoyed prosperity in 1945 and were able to pay their obligations to the United States. Aiding to meet the Nation-wide demand for more food, reclamation projects were responsible for the production of 11,814,337 tons of food and forage crops in 1945.

Major Land Development Programs

During the fiscal year 1946 two great reclamation developments were initiated—one in the Missouri Basin in accordance with the congressional uthorization of December 1944 and the other in the Columbia Basin in ccordance with the 1943 act of Congress. Those projects will bring into roduction large new irrigation blocks and will create many thousand new rms for settlement by veterans. On each project a development staff has een established for the purpose of providing the necessary basic agriculral and economic information concerning soils, crops, markets, repayent ability, and related information, together with the needed demontrations for practical adaptation of irrigation farming practices to the ew areas. The Missouri Basin project development staff also has an nportant immediate job in the development of new repayment contracts eeded before delivery of irrigation water.

Var Relocation Authority Centers on Reclamation Projects

During the fiscal year arrangements were made for retransferring to the ureau of Reclamation areas of public land in the Tule Lake division, lamath project, California; Gooding division, Minidoka project, Idaho; nd the Heart Mountain division, Shoshone project, Wyoming, which had een made available during the war period to the War Relocation Authorty for use as relocation centers. Temporarily such lands previously farmed nder the direction of the War Relocation Authority have been leased to ndividuals in order that the areas would not go out of production during 1946. At the expiration of these one-year leases the area will be subject to reclamation homestead entry. Arrangements were being made under an amendment to the Interior Department Appropriation Act for 1947, for the transfer of real and personal property of these three War Relocation centers to the Bureau of Reclamation.

Operation and Maintenance Objectives

Irrigation water was made available in the 1946 irrigation season for the first time to nine projects on which construction had been carried forward during the war years as a part of the national effort to increase production of much needed food supplies. Approximately 43,500 additional acres will be irrigated in 1946 as a result of Bureau activities on these projects, which are the Altus, Deschutes, Intake, Kendrick, Mirage Flats, Newton, Scofield, Rathdrum-Prairie, and Tucumcari. In addition, on the Roza division of the Yakima project approximately 8,500 acres of land are being irrigated in 1946 for the first time.

Commencement of Construction Charge Payments

During the fiscal year public notices were issued announcing the commencement of construction charge payments in 1946 for two completed projects (Owyhee and Vale) and a portion of the irrigable land in the Roza division of the Yakima project. A total of 143,806 irrigable acres come under these notices, and the aggregate initial annual assessments will amount to $325,296.

Amendatory and New Repayment Contracts

The accelerated postwar construction program now under way intensifies the Bureau's work on both new and amendatory repayment contracts. Building upon the experience of the past, a new approach is being taken in negotiating repayment contracts. Added emphasis is being given to the requirement of reimbursability of funds expended for irrigation development traditionally established by statute and policy. In addition, reimbursability is taking on new meaning with the increasing development of multiple-purpose projects embracing many features other than irrigation, such as hydroelectric power, flood control, navigation, fish and wildlife, protection and recreational activities. Problems related to land development are concerned with the reimbursability of those funds allocated to irrigation under which water users undertake to repay the Federal Treasury.

Determinations of the ability of water users to meet the reimbursable costs are an important consideration. The present program in this respect is designed to have a vital influence in the successful consummation of repayment contracts. Economic surveys, land classification, and farm management programs are included. The latter give special emphasis to the beneficial use of irrigation water to assure maximum crop production and permanent beneficial land use practices. Guidance for settlers is provided by the Bureau and cooperating Federal and State agencies.

Time is necessary before these activities can be made to function efficiently. Over a period of years they will have an important role in influencing the entire repayment program of the Bureau and should have far-reaching and beneficial results.

Deferment of construction installments was granted under existing law in the case of three projects during the year. These deferments, totaling $67,884.50, for the Milk River project, Montana; Westland irrigation district, Oregon; and the Northport irrigation district, North Platte project, Nebraska, were granted in view of peculiar difficulties affecting the repayment ability of the water users.

On October 18, 1945, the Secretary of the Interior executed the first of the Central Valley project water contracts. During the following months negotiations with approximately 12 additional irrigation districts have been prosecuted with a view to making available the full Friant-Kern supply throughout the San Joaquin Valley. The general form of contract utilized in these negotiations is for water service over a 40-year period at a rate that will not exceed a maximum of about $3.50 per acre foot. That type of contract is made necessary by the character of the project, involving among other things extensive water exchanges and other physical features that preclude the standard repayment arrangements. However, the excess land limitations and other requirements of law are fully incorporated in the Central Valley contract form. Where needed, separate 40-year contracts are to be provided to cover distribution systems.

Land Ownership Survey

The extent of excess land holdings on the Federal reclamation projects was made the subject of an intensive survey and study, initiated because of the great interest being shown in the matter and the misunderstanding in recent years both as to the policies which Congress has laid down with respect to acreage limitation on the lands served by reclamation projects and as to the actual administration of these policies in the settlement and development of reclamation projects.

The survey showed that on projects now receiving water, the farms are preponderantly family-size farms. Ninety-seven percent of these farms containing 70 percent of the total irrigable acreage, are 160 acres or less in size, and 84 percent of the acreage is in farms not exceeding 320 acres. Only eight-tenths of 1 percent of the ownerships on projects receiving water in 1946 contain excess land which appears to be in violation of acreage limitations under Reclamation law. These ownerships contain only 3.8 percent of the entire irrigable area surveyed on the projects.

Canal Lining Program

During the fiscal year a program of research and testing of lower-cost canal linings was undertaken jointly by the Branches of Design and Construction, Operation and Maintenance, and the Regional Directors, for use in connection with the large construction program now under way and the needed rehabilitation of operating projects. The program will include an investigation of all types of canal linings now in existence, installation of measuring devices, and field studies to obtain accurate data on seepage losses.

Rehabilitation of Operating Irrigation Projects

The war years and the economic depression were periods when the irrigation facilities of operating projects received little attention. Scarcity of labor, materials, and supplies made it almost impossible for the water users to maintain the irrigation works in first-class operating condition. During the latter part of calendar year 1945, preliminary survey was made by the Bureau which revealed the possible need for extensive expenditures to repair, replace and restore various features on these operating projects.

During the first part of fiscal year 1947, it is expected to complete the detailed survey of each operating project which was completed and placed in operation prior to January 1, 1942. The results of the survey will determine the amount of rehabilitation work needed to restore the dams, canals, laterals, structures, and other complementary works.

TABLE 2.—*Settlement and economic data, 1945*

REGULAR PROJECTS

State	Project	Irrigated farms		Towns on or tributary to the project		Number of schools	Number of churches	Banks			Special Warren Act contractors	
		Number	Population	Number	Population			Number	Deposits	Number of depositors	Irrigated farms [1]	Population
Arizona	Salt River	13,087	41,800	9	191,300	98	165	8	$176,973,926	95,000	951	5,619
	Gila (Mesa division)	12	60	0	0	0	0	0	0	0		
Arizona-California	Yuma	1,741	2,877	5	14,390	14	35	3	(2)	(2)		
California	Orland	667	1,952	1	1,600	5	12	1	4,200,000	3,309		
Colorado	Grand Valley [3]	520	1,427	6	25,700	17	40	3	21,297,868	14,000	807	1,830
	Uncompahgre	1,885	4,863	3	8,700	28	35	4	12,692,863	7,200	172	288
Idaho	Boise	4,236	15.250	16	55,895	118	131	6	216,121,865	(2)	4,764	19,516
	Minidoka	3,508	11,161	10	15,496	32	73	6	(2)	(2)	9,708	44,065
Montana	Bitter Root	326	1,061	5	4,532	15	13	4	7,457,264	5,290		
	Frenchtown	43	185	1	100	1	1	0	0	0		
	Huntley	647	1,268	5	691	7	6	1	554,705	503		
	Milk River	722	2,574	15	11,778	29	38	7	18.820,313	10,499		
	Sun River	1,014	2,550	5	900	10	15	1	(2)	(2)		
Montana-North Dakota	Lower Yellowstone	648	2,210	7	4,620	17	22	3	7,408,555	4,592		
Nebraska-Wyoming	North Platte	2,613	7,552	16	28,239	72	72	11	28,099,953	(2)	1,099	5,989
Nevada	Newlands	805	2,584	4	3,500	16	12	1	3,806,000	2,974		
New Mexico	Carlsbad	457	2,100	4	20,900	14	20	2	9,000,000	8,000		
New Mexico-Texas	Rio Grande	6,498	33,060	40	155,908	84	153	6	147,114,998	63,313	181	1,810
Oregon	Umatilla (east and west divisions)	400	1,260	5	3,227	7	16	1	3,220,308	2,914	37	71
	Vale	518	1,847	4	1,300	8	14	1	3,010,000	2,000		
Oregon-California	Klamath	991	2,938	5	33,865	30	35	4	(2)	(2)	560	1,680
Oregon-Idaho	Owyhee	1,564	7,160	8	19,850	28	25	8	(2)	(2)	235	705
South Dakota	Belle Fourche	591	1,616	5	3,788	25	23	3	8,038,529	6,006		
Utah	Strawberry Valley	1,961	6,500	6	15,242	22	21	4	11,186,414	14,517		
Washington	Okanogan	393	1,074	3	5,000	8	8	2	7,480,332	4,300		
	Yakima	5,473	20,237	24	59,221	51	91	9	28,037,094	19,102	4,590	17,162
Wyoming	Riverton	500	1,330	3	3,165	4	19	1	2,966,055	2,800	2	9
	Shoshone	1,028	1,917	6	6.765	3	15	1	3,089,609	2,091		
	Total	52,848	180,413	221	695,672	763	1,110	101	720,576,651	268,410	23,106	98,744

SUPPLEMENTAL STORAGE PROJECTS

California	All-American Canal: Imperial Valley	4, 511	28, 000	8	42, 000	63	26	7	(2)	(2)		
Colorado	Fruitgrowers Dam	88	352	1	300	2	2	0	0	0		
	Pine River	293	745	5	1, 007	20	12	1	$542, 099	500		
Idaho	Minidoka (Fremont-Madison irrigation district).	1, 198	4, 840	14	9, 990	23	33	4	8, 236, 452	8, 634		
Nevada	Humboldt	138	204	1	1, 200	3	4	1	(2)	(2)		
	Truckee River Storage	1, 270	2, 700	2	32, 000	21	21	3	33, 000, 000	22, 500		
Oregon	Baker	40	146	1	8	4	0	0	0	0		
	Burnt River	118	925	8	2, 500	8	4	1	510, 000	(2)		
	Deschutes (Central Oregon irrigation district).	755	2, 175	6	15, 400	23	32	4	6, 600, 000	5, 700		
	Stanfield	160	491	1	563	2	2	0	0	0		
	Westland	98	201	0	0	0	0	0	0	0		
Utah	Hyrum	579	2, 895	3	3, 900	5	6	0	0	0		
	Moon Lake	654	3, 400	11	4, 500	9	17	1	2, 292, 915	3, 439		
	Ogden River	1, 100	4, 300	8	80, 000	34	60	4	40, 000, 000	36, 000		
	Provo River (Deer Creek division)	1, 260	3, 000	7	58, 425	24	47	6	22, 378 074	20, 420		
	Sanpete	223	697	2	2, 792	5	4	1	1, 715, 000	(2)		
	Weber River	3, 000	15, 000	21	27, 000	31	26	8	50, 000, 000	40, 000		
	Total	15, 485	70, 071	99	281, 585	277	296	41	165, 274, 540	137, 193		

WATER CONSERVATION AND UTILIZATION PROJECTS

Montana	Buffalo Rapids:											
	First division	131	350	2	1, 300	6	14	3	$6, 400, 000	4, 800		
	Second division	52	156			4	9	1	2, 263, 795	1, 150		
North Dakota	Buford-Trenton	40	120									
	Total	223	626	2	1, 300	10	23	4	8, 663, 795	5, 950		
	Grand total	68, 556	251, 110	322	978, 557	1, 050	1, 429	146	894, 514, 986	411, 553	23, 106	98, 744

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[1] Farms furnished partial or whole water supply under Warren Act or other special contracts.
[2] Data not reported.
[3] Gravity division only; does not include Orchard Mesa irrigation district.

TABLE 3.—*Cumulative crop values, 1906–45*

Year	Federal irrigation projects [1]				Warren Act lands and special contractors				Entire area			
	Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value	
			For year	Cumulative total			For year	Cumulative total			For year	Cumulative total
1906	22,300	[2] 20,100	$244,900						22,300	[2] 20,100	$244,900	
1907	187,628	[2] 169,000	4,760,460	$5,005,360					187,628	[2] 169,000	4,760,460	$5,005,360
1908	289,549	[2] 260,500	7,635,888	12,641,248					289,549	[2] 260,500	7,635,888	12,641,248
1909	410,628	[2] 369,500	11,920,663	24,561,911					410,628	[2] 369,500	11,920,663	24,561,911
1910	471,423	413,000	12,944,639	37,506,550					471,423	413,000	12,944,639	37,506,550
1911	562,311	470,100	13,086,441	50,592,991					562,311	470,100	13,086,441	50,592,991
1912	614,477	540,000	16,007,134	66,600,125					614,477	540,000	16,007,134	66,600,125
1913	694,142	637,227	15,676,409	82,276,534					694,142	637,227	15,676,409	82,276,534
1914	761,271	703,424	16,475,517	98,752,051					761,271	703,424	16,475,517	98,752,051
1915	810,649	760,035	18,164,452	116,916,503					810,649	760,035	18,164,452	116,916,503
1916	922,821	858,291	32,815,972	149,732,475					922,821	858,291	32,815,972	149,732,475
1917	1,026,663	966,784	56,462,313	206,194,788					1,026,663	966,784	56,462,313	206,194,788
1918	1,119,566	1,051,193	66,821,396	273,016,184	[2] 501,100	[2] 481,600	$35,000,000		[2] 1,620,666	1,532,793	101,821,396	308,016,184
1919	1,187,255	1,113,469	88,974,137	361,990,321	916,313	880,613	64,368,468	$99,368,468	2,103,568	1,994,082	153,342,605	461,358,789
1920	1,223,480	1,153,820	66,171,650	428,161,971	981,940	950,890	47,836,750	147,205,218	2,205,420	2,104,710	114,008,400	575,367,189
1921	1,227,500	1,157,900	49,620,300	477,782,271	1,001,250	969,550	45,288,630	192,493,848	2,228,750	2,127,450	94,908,930	670,276,119
1922	1,202,130	1,169,100	50,360,850	528,143,121	983,290	951,270	33,240,840	225,734,688	2,185,420	2,120,370	83,601,690	753,877,809
1923	1,213,700	1,179,870	65,046,300	593,189,421	1,051,380	993,040	37,557,860	263,292,548	2,265,080	2,172,910	102,604,160	856,481,969
1924	1,290,890	1,216,610	66,488,560	659,677,981	930,670	889,460	43,237,470	306,530,018	2,221,560	2,106,070	109,726,030	966,207,999
1925	1,320,300	1,242,750	77,608,880	737,286,861	1,019,170	951,250	53,655,850	360,185,868	2,339,470	2,194,000	131,264,730	1,097,472,729
1926	1,411,020	1,328,810	60,369,620	797,656,481	1,097,190	949,590	49,750,040	409,935,908	2,508,210	2,278,400	110,119,660	1,207,592,389
1927	1,378,990	1,326,810	70,985,450	868,641,931	1,148,115	1,072,486	61,160,010	471,095,918	2,527,105	2,399,296	132,145,460	1,339,737,849
1928	1,442,080	1,385,560	80,238,800	948,880,731	1,235,020	1,192,030	62,495,320	533,591,238	2,677,100	2,577,590	142,734,120	1,482,471,969
1929	1,483,900	1,420,070	87,559,670	1,036,440,401	1,234,230	1,192,990	72,720,490	606,311,728	2,718,130	2,613 060	160,280,160	1,642,752,129
1930	1,504,810	1,467,097	64,418,940	1,100,859,341	1,286,046	1,254,493	54,654,550	660,966,278	2,790,856	2,721,590	119,073,490	1,761,825,619
1931	1,522,718	1,462,565	40,121,089	1,140,980,430	1,293,889	1,251,830	33,406,340	694,372,618	2,816,607	2,714,395	73,527,429	1,835,353,048
1932	1,555,144	1,506,320	31,165,752	1,172,146,182	1,214,461	1,196,400	18,627,219	712,999,837	2,769,605	2,702,720	49,792,971	1,885,146,019
1933	1,589,770	1,529,903	48,138,576	1,220,284,758	1,239,017	1,199,113	35,425,870	748,425,707	2,828,787	2,729,016	83,564,446	1,968,710,465
1934	1,552,124	1,464,405	59,628,327	1,279,913,085	1,285,081	1,229,594	40,160,676	788,586,383	2,837,205	2,693,999	99,789,003	2,068,499,468
1935	1,640,936	1,604,166	63,601,663	1,343,514,748	1,294,680	1,256,970	43,179,631	831,766,014	2.935,616	2,861,136	106,781,294	2,175,280,762
1936	1,702,192	1,629,174	78,902,818	1,422,417,566	1,335,995	1,272,745	57,599,662	889,365,676	3,038,187	2,901,919	136,502,480	2,311,783,242
1937	1,725,463	1,700,969	72,893,649	1,495,311,215	1,389,338	1,333,800	45,764,623	935,130,299	3,114,801	3,034,769	118,658,272	2,430,441,514
1938	1,777,584	1,764,363	67,859,804	1,563,171,019	1,329,115	1,276,332	45,603,656	980,733,955	3,106,699	3,040,695	113,463,460	2,543,904,974
1939	1,922,868	1,903,269	73,769,654	1,636,940,673	1,218,108	1,174,803	40,313,140	1,021,047,095	3,140,976	3,078,072	114,082,794	2,657,987,768

1940	2, 152, 808	2, 138, 927	80, 098, 196	1, 717, 038, 869	1, 238, 262	1, 177, 103	37, 690, 481	1, 058, 737, 576	3, 391, 070	3, 316, 030	117, 788, 677	2, 775, 776, 445
1941	2, 199, 179	2, 178, 288	110, 399, 806	1, 827, 438, 675	1, 140, 204	1, 202, 172	49, 386, 191	1, 108, 223, 767	3, 339, 383	3, 380, 460	159, 885, 997	2, 935, 662, 442
1942	2, 277, 955	2, 259, 653	155, 619, 716	1, 983, 058, 391	1, 602, 907	1, 562, 046	116, 428, 800	1, 224, 652, 567	3, 880, 862	3, 821, 699	272, 048, 516	3, 207, 710, 958
1943	2, 422, 288	2, 398, 922	218, 064, 208	2, 201, 122, 599	1, 633, 041	1, 615, 424	170, 606, 761	1, 395, 259, 328	4, 055, 329	4, 014, 346	388, 670, 969	3, 596, 381, 927
1944	2, 468, 842	2, 475, 280	224, 683, 280	2, 425, 805, 879	1, 694, 881	1, 664, 069	186, 543, 084	1, 581, 802, 412	4, 163, 703	4, 139, 349	411, 226, 364	4, 007, 608, 291
1945	2, 416, 961	2, 464, 672	232, 545, 321	2, 658, 351, 200	1, 745, 627	1, 731, 060	202, 639, 074	1, 784, 441, 486	4, 162, 588	4, 195, 732	435, 184, 395	4, 442, 792, 686

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[1] Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by the United States.

[2] Estimated.

TABLE 4.—*Projects in operation—Irrigation and crop value data for the calendar year 1945*

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
			Land subject to construction charges			Temporarily suspended lands [2]					Crop values					Crop values	
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Total	Per acre	Irrigable area	Irrigated area	Net area in cultivation	Total	Per acre
				Total	Per acre												
ARIZONA																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Salt River	243, 125	214, 346	228, 533	$33, 034, 154	$144. 55	0	0						99, 807	81, 736	78, 944	$8, 377, 548	$106. 12
Gila-Yuma Mesa division	4, 262	3, 688	5, 673	177, 578	31. 30	0	0										
ARIZONA-CALIFORNIA																	
Yuma:																	
Valley division, Arizona	50, 390	45, 359	44, 763	6, 811, 119	152. 16	671	$10, 541										
Reservation division, California	7, 743	2, 748	2, 748	156, 249	56 86	0	0										
Bard division, California	6, 882	5, 400	5, 392	368, 675	68. 37	80	808										
Yuma Auxiliary (Mesa), Arizona	4, 025	1, 619	1, 619	1, 059, 111	654. 18	0	0										
Total—Yuma project	69, 040	55, 126	54, 522	8, 395, 154	153. 98	751	11, 349										
CALIFORNIA																	
All - American Canal:																	
Imperial irrigation district													523, 000	393, 786	393, 786	62, 298, 113	158. 20
Central Valley [3]													164, 897	95, 482	95, 482	18, 302, 432	191. 68
Orland	20, 147	16, 614	16, 614	1, 558, 785	93. 82	0	0										

COLORADO																
Fruitgrowers Dam								2, 662	2, 022	2, 022	$249, 779	$123. 53				
Grand Valley:																
Gravity division	30, 444	20, 124	20, 124	1, 306, 445	64. 92	0	0									
Orchard Mesa irrigation district [4]	10, 027	8, 123	8, 123	2, 112, 388	260. 05	0	0									
Total—Grand Valley project	40, 471	28, 247	28, 247	3, 418, 833	121. 03	0	0						8, 400	7, 470	7, 470	1, 968, 323	263. 50
Pine River								35, 933	25, 452	25, 452	626, 840	24. 63					
Uncompahgre	93, 885	63, 184	62, 044	2, 892, 816	46. 63	1, 140	40, 036						6, 288	5, 060	5, 060	263, 581	52. 09
IDAHO																
Boise:																
Big Bend irrigation district	1, 696	1, 416	1, 417	85, 865	60. 60	0	0									
Black Canyon irrigation district (Notus)	6, 883	6, 116	6, 116	791, 864	129. 47	0	0									
Black Canyon irrigation district (Payette)	27, 760	19, 496	19, 684	1, 020, 867	51. 86	0	0									
Boise-Kuna irrigation district	48, 546	44, 607	44, 588	3, 412, 487	76. 53	19	285									
Nampa-Meridian irrigation district	40, 083	34, 893	35, 047	2, 533, 191	72. 28	46	0									
New York irrigation district	17, 382	15, 053	15, 298	624, 913	40. 85	0	0									
Settlers irrigation district	518															
Wilder irrigation district	56, 492	49, 985	49, 022	5, 960, 773	121. 59	1, 030	12, 857									
Total—Boise project	199, 360	171, 566	171, 172	14, 429, 960	84. 30	1, 095	13, 142						125, 303	116, 328	116, 328	8, 644, 557	74. 31
Minidoka:																
Minidoka irrigation project	71, 846	62, 141	61, 487	4, 655, 767	75. 72	654	0									
Burley irrigation district	47, 937	44, 293	44, 293	3, 811, 573	86. 05	0	0									
American Falls Reservoir district No. 2	92, 138	79, 130	79, 627	3, 674, 595	46. 15	0	0									
Fremont - Madison irrigation district								93, 682	85, 681	87, 678	5, 378, 854	61. 35					
Total — Minidoka project	211, 921	185, 564	185, 407	12, 141, 935	65. 49	654	0						707, 633	684, 753	684, 753	51, 732, 145	75. 55

See footnotes at end of table, p. 75.

TABLE 4.—*Projects in operation—Irrigation and crop value data for the calendar year 1945*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area[1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
MONTANA	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Bitter Root [4]	16, 553	16, 392	16, 553	$686, 955	$41. 50	0	0										
Buffalo Rapids:																	
First division	13, 109	12, 630	12, 787	579, 906	45. 35	0	0										
Second division	8, 100	4, 886	4, 886	60, 979	12. 48	0	0										
Total — Buffalo Rapids project [5]	21, 209	17, 516	17, 673	640, 885	36. 26	0	0										
Frenchtown	4, 878	2, 195	2, 807	131, 740	46. 93	0	0										
Huntley	29, 590	24, 195	17, 012	1, 020, 931	60. 01	7, 426	$190, 219										
Milk River:																	
Malta division	56, 652	23, 999	14, 658	645, 927	44. 07	9, 742	123, 053										
Glasgow division	21, 997	6, 745	8, 184	317, 222	38. 76	205	4, 573										
Chinook division	43, 484	25, 801	26, 792	1, 370, 982	51. 17	0	0										
Pump lands	3, 848	3, 848	3, 847	317, 192	82. 45	0	0										
Total—Milk River project	125, 981	60, 393	53, 481	2, 651, 323	49. 58	9, 947	127, 626										
Sun River:																	
Fort Shaw division	13, 902	7, 682	8, 301	183, 934	22. 16	188	3, 396										
Greenfields division	82, 963	68, 457	72, 184	1, 560, 487	21. 62	0	0										
Total—Sun River project	96, 865	76, 139	80, 485	1, 744, 421	21. 67	188	3, 396										

MONTANA-NORTH DAKOTA																	
Lower Yellowstone:																	
District No. 1, Montana	36, 977	32, 304	31, 496	1, 897, 818	60. 26	808	32, 509										
District No. 2, North Dakota	19, 689	15, 787	15, 419	782, 502	50. 75	368	16, 922										
Total—Lower Yellowstone project	56, 666	48, 091	46, 915	2, 680, 320	57. 13	1, 176	49, 431										
NEBRASKA-WYOMING																	
North Platte:																	
Pathfinder irrigation district	112, 943	86, 043	74, 650	4, 335, 681	58. 08	11, 393	208, 840										
Gering & Fort Laramie irrigation dam	54, 845	51, 994	50, 579	3, 134, 029	61. 96	1, 415	22, 647										
Goshen irrigation district, Wyoming	52, 486	45, 698	42, 708	2, 556, 413	59. 86	2, 990	21, 740										
Northport irrigation district	16, 170	9, 608	8, 564	261, 388	30. 52	1, 044	11, 014										
Total — North Platte project	236, 444	193, 343	176, 501	10, 287, 511	58. 29	16, 842	264, 241						108, 715	100, 414	97, 200	$5, 673, 441	$58. 37
NEVADA																	
Humboldt								37, 046	17, 928	17, 928	1, 034, 666	$57. 71					
Newlands	67, 469	57, 662	57, 682	2, 290, 767	39. 71	1, 190	11, 917										
Truckee River storage								29, 376	(No report received)								
NEW MEXICO																	
Carlsbad	25, 055	20, 715	20, 715	1, 539, 967	74. 34	0	0										
NEW MEXICO-TEXAS																	
Rio Grande:																	
Elephant Butte Irrigation District, New Mexico	88, 000	88, 714	85, 256	11, 692, 644	137. 15	3, 754	309, 580										
El Paso County water improvement district No. 1, Texas	67, 000	65, 747	63, 125	10, 142, 062	160. 67	2, 727	245, 688										
Total—Rio Grande project	155, 000	154, 461	148, 381	21, 834, 706	147. 15	6, 481	555, 268						17, 793	15, 220	15, 220	2, 0, 75696	135. 14

See footnotes at end of table, p. 75.

TABLE 4.—*Projects in operation—Irrigation and crop value data for the calendar year 1945*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
NORTH DAKOTA																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Buford-Trenton [5]	10,985	8,776	8,77	177,783	$20.26	0	0										
OREGON																	
Baker								7,312	7,312	7,312	$209,206	$28.61					
Burnt River								15,291	15,291	15,291	385,719	25.23					
Deschutes—Central Oregon irrigation district								42,382	38,388	38,388	3,094,854	80.62					
Stanfield								6,000	4,998	4,998	177,008	35.42					
Umatilla:																	
East division	10,911	6,693	6,693	322,250	48.15	0	0										
West division	7,620	4,792	5,009	164,735	32.89	0	0										
Total—Umatilla project	18,531	11,485	11,702	486,985	41.62	0	0						1,003	828	909	$90,168	$99.19
Vale	32,000	31,145	31,145	2,371,300	76.14	0	0										
Westland								8,052	3,963	3,963	136,914	34.55					
OREGON-CALIFORNIA																	
Klamath:																	
Main division, Oregon	41,081	31,901	31,527	4,233,185	134.27	915	$38,117										
Tule Lake division, California	25,569	24,338	24,498	4,590,689	187.39	0	0										
Total—Klamath project	66,650	56,239	56,025	8,823,874	157.50	915	38,117						79,867	63,081	63,081	5,625,844	89.18

OREGON-IDAHO																
Owyhee:																
Advancement irrigation district	701	625	640	46,145	72.10	0	0									
Bench irrigation district	2,310	2,241	2,241	380,338	169.72	0	0									
Crystal irrigation district	1,264	1,166	1,166	285,480	244.84	0	0									
Owyhee irrigation district	55,375	49,012	49,725	4,505,841	90.62	0	0									
Payette-Oregon Slope irrigation district	4,601	4,197	4,202	875,523	208.36	0	0									
Ontario-Nyssa irrigation district	5,920	5,592	5,622	662,449	117.83	0	0									
Gem irrigation district, Idaho	30,213	28,826	28,733	2,571,491	89.50	776	44,054									
Slide irrigation district	1,092	1,067	1,068	130,075	121.79	0	0									
Total—Owyhee project	101,476	92,726	93,397	9,457,342	101.26	776	44,054						13,800	13,130	13,130	1,617,259	123.17
SOUTH DAKOTA																
Belle Fourche	72,431	42,435	51,340	1,409,945	27.46	565	0									
UTAH																
Lyrum								6,261	5,717	5,779	289,767	50.14					
Moon Lake								72,608	56,255	56,255	779,372	13.85					
Ogden River								21,713	15,458	15,458	1,292,227	83.60					
Provo River—Deer Creek division								38,927	27,163	27,899	4,276,065	153.27					
Sanpete:																
Ephraim division								6,700	5,458	5,704	165,788	29.07					
Spring City division								6,017	4,382	4,532	115,176	25.41					
Total—Sanpete project								12,717	9,840	10,236	280,964	27.45					
Strawberry Valley:																
Highline division	18,404	16,263	16,953	911,681	53.78	0	0									
Spanish Fork division	13,725	12,789	13,060	871,331	66.72	0	0									
Springville-Mapleton division	8,867	8,120	8,368	835,711	99.87	0	0									
Total—Strawberry Valley project	40,996	37,172	38,381	2,618,723	68.23	0	0						7,659	7,136	7,287	477,636	65.55
Weber River: Salt Lake Basin								91,374	89,478	90,118	13,797,750	153.11					

See footnotes at end of table, p. 75.

Table 4.—*Project in operation—Irrigation and crop valve data for the calender year 1945*—Continued

State, project, and subdivision	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area[1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands[2]		Irrigable area[1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
WASHINGTON	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Okanogan	5,333	3,961	3,961	$2,436,849	$615.21	0	0										
Yakima:																	
Sunnyside division	103,579	81,354	83,465	14,829,247	177.67	468	16,962										
Tieton division	27,588	24,679	24,576	20,979,434	853.66	0	0										
Kittitas division	69,552	54,194	54,479	2,883,405	52.93	97	776										
Roza division	40,446	18,555	18,445	3,736,816	202.59	99	19,462										
Total—Yakima project	241,165	178,782	180,965	42,428,902	234.46	664	37,200						190,195	160,817	152,024	$35,494,381	$233.48
WYOMING																	
Riverton	42,500	38,641	38,760	1,467,086	37.85	0	0						386	386	386	16,850	43.6 5
Shoshone:																	
Garland division	41,627	34,144	33,296	1,608,642	48.31	848	13,377										
Frannie division	19,951	10,931	10,000	323,943	32.39	931	16,197										
Willwood division	11,542	10,275	10,206	456,916	44.77	69	0										
Heart Mountain division	13,938																
Total—Shoshone project	87,058	55,350	53,502	2,389,501	44.66	1,848	29,574										
Total	2,437,046	1,966,149	1,958,371	195,627,031	99.89	51,658	1,415,570	521,336	404,946	408,777	$32,006,985	$78.31	2,054,746	1,745.627	1,731,060	202,639,074	117.06
Total—regular projects	2,437,046	1,966,149	1,958,371	195,627,031	99.89												
Total—storage projects	521,336	404,946	408,777	32,009,985	78.31												
Total—special and Warren Act lands	2,054,746	1,745,627	1,731,060	202,639,074	117.06												

Additional areas reported:																	
Temporarily suspended			51, 658	1, 415, 570	27. 40												
Leased areas, WRA Center, etc		45, 866	45, 866	3, 492, 735	76. 15												
Total	5, 013, 128	4, 162, 588	4, 195, 732	435, 184, 395	103. 72												
Additional irrigable lands, no crop details reported [6]	17, 208																
Grand total, 1945	5, 030, 336	4, 162, 588	4, 195, 732	435, 184, 395	103. 72												
Grand total, 1944	4, 885, 251	4, 163, 703	4, 139, 349	411, 226, 364	99. 27												
Increase, 1944-45, total	145, 085	−1, 115	56, 383	23, 958, 031	4. 45												

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[1] Area for which Bureau is prepared to supply water.

[2] Generally part of irrigable area but not subject to construction charges until reclaimed.

[3] Estimated figures in this report cover lands receiving water by operation of Shasta and Friant Dams under interim contracts. Additional lands in the Sacramento and San Joaquin Valleys received indirect benefits during 1945.

[4] Private projects reconstructed with Government funds.

[5] Water conservation and utilization projects.

[6] North and South Gila Valleys (Gila project), Arnold and Lone Pine irrigation districts (Deschutes project).

NOTE.—Per acre value based on net area in cultivation.

Planning Horizons

Comprehensive investigations of irrigation and multiple-purpose projects in the major river basins of the West were rapidly advanced or completed during the fiscal year with regular and supplemental appropriations for planning investigations greater than ever previously available.

Although regular appropriations made before cessation of hostilities were small, supplemental appropriations were quickly made available by the Congress after the fall of Japan.

Comprehensive surveys of 25 major river basins and some 200 investigations of sub-basins and projects were in progress during the year. Six basin and project reports comprising Santa Barbara County, Calif.,[1] Lewistown Orchards, Idaho, Payette Unit of Mountain Home, Idaho,[1] Paonia, Colo., projects and Central Valley, Calif.,[2] and Colorado River Basin comprehensive reports, were completed. Hearings on authorization of construction and development of the Lewistown Orchards project were in progress before the Senate Committee on Irrigation and Reclamation at the end of the year.

Stepped-up progress on investigations of other basins and projects has enabled scheduling many of them for field completion during the next fiscal year.

Increased emphasis was given to the development of new techniques in studies of meteorology, hydrology, and in the investigations of sedimentation. Assistance was given to regional and project offices in making investigations of land classifications, land use, farm organization, industrial resources, benefits, costs, and other economic phases of project planning.

Basic information on the historical trends of farm commodity prices was assembled and conferences held with commodity specialists of the United States Department of Agriculture to develop the farm price outlook. These data and opinions are being used to determine the agricultural commodity price levels to be used in planning irrigation projects.

Some 35 reports covering flood control and river and harbor improvements submitted to the Secretary of the Interior by the Corps of Engineers of the War Department in accordance with the Flood Control Act of 1944 were reviewed and commented on during the year. The Branch of Project Planning and other offices in the Bureau and in the Department review such reports with particular attention to their relation to water supplies for irrigation, power, municipal purposes, and other multiple uses.

To bring about greater uniformity in practices among the Federal agencies concerned with development of water resources, personnel in the

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[1] Some revisions of these reports may be required in the light of comments received from the Bureau of the Budget.

[2] This report requires further consideration, which it is not actively receiving, in the light of comments by the State of California and by the Secretary of War.

Branch of Project Planning represent the Bureau on the Federal Inter-Agency River Basin Committee's subcommittees on benefits and costs, correlation of hydrologic data, sedimentation, and on preparation of statement of differences between the Interior and War Department reports on the Central Valley of California.

In attempting to expand Planning activities in the field to a degree commensurate with the increase in investigation funds, considerable difficulty was encountered in obtaining sufficient qualified personnel and essential equipment, particularly transportation equipment. Although during the latter half of the fiscal year, release of men from the armed services alleviated the general situation appreciably and the equipment problem was being slowly solved, lack of housing for personnel continued to handicap the planning program. In the face of these difficulties, some of the funds appropriated for planning in fiscal year 1946 were carried over into fiscal year 1947.

Power for the West

A major element in the Bureau of Reclamation postwar plan for the development of the West is the program for the development of additional sources of electric power and the construction of the transmission lines required to bring such power to market. The inevitable result of this vast development program will be the creation of new communities, both agricultural and industrial. One of the major factors influencing the shaping of the social structure of such modern communities is low cost electric power. The utilization of the potential power made available through the harnessing of rivers by means of multiple-purpose projects is of necessity an integral part of the postwar program. Moreover, the sale of this power benefits the project areas in two important respects. First, it makes available in an impartial manner with preference to public agencies and municipalities low cost electric energy, without which the development of the project areas would be impeded. Secondly, the revenues from the sale of such power repays to the Federal treasury the major part of the cost of the project and thereby greatly assists the project in meeting the payout requirements set forth in the Reclamation law.

With the above factors in mind, the Bureau of Reclamation is developing its program to meet the power requirements with the most suitable and efficient power systems that are possible to obtain. The year ended June 30, 1946, found an auspicious start made in the actual construction of these power systems.

The power development proposed by the Bureau offers the solution to two basic problems facing the States of the West. It will provide adequate quantities of low cost power for the development of new industries in these States; industries which will utilize the heretofore untapped vast store of mineral resources as well as the related agricultural products in this section of the country. Lack of sufficient electric power has been a principal handicap to earlier development. The program will also provide a stimulus to the agricultural development of these States by making low-cost power available for pumping water to irrigate thousands of acres of arid land. Already the exigencies of the war has resulted in developments along these lines and has created a market for additional electric power in those areas.

During the war the Bureau's power facilities were overloaded even though a spectacular expansion was made to meet the power requirements of the industries. Now, almost a year after the cessation of hostilities, this overloading continues and it is clear that several areas in the Western States which received large quantities of power for war work from Bureau power plants will require even more power for vastly expanded peacetime industrial developments stimulated by wartime developments and increased domestic usage resulting from the large population increases. The continued growth and development of certain western areas will be hampered seriously unless additional power is made available. In some cases this condition is aggravated by the approaching obsolescence of fuel-burning power plants or the expected depletion of low cost fuel resources. The logical solution to this problem is the utilization of falling water, a recurring resource, as the source of power. The Bureau and other agencies are making power studies of various areas where critical power shortages have already occurred or will occur if additional generating capacity is not provided. The results of these studies will indicate the power developments whose construction must be accelerated in order to meet the energy requirements of those areas.

In the period between VJ-day and the end of the fiscal year, the Bureau was faced with serious shortages of manpower and of materials of almost every item required for power plant construction. In spite of these difficulties, substantial progress was made on the construction program. Exceptional progress has been made on the engineering and design phases of the program and the Bureau has prepared the foundation for an accelerated program for the forthcoming years.

Included in the Bureau's power development program is a proposed system of transmission lines connecting load centers with sources of power. The Bureau's policy to market power in wholesale quantities at transmission line voltages, giving preference to public agencies such as municipalities and cooperative groups can only be achieved by the construction of a well-planned transmission network. In order to accomplish this, it is necessary that the Government build these transmission lines to assure that the power will be available to such organizations at load centers at the lowest cost possible. In addition, a well coordinated system for delivering power continuously as cheaply as possible makes it imperative that a unified development of the central stations and transmission line facilities take place.

A significant start on the program of transmission line construction has also been made within the last year. Construction has started on several of the principal lines which will become important links in future systems. These systems will be rounded out to completion to coordinate the installation of generating equipment and transmission and substation facilities to coincide with the demands for additional power.

Another aspect of the Bureau's transmission line program is the construction of additional line facilities to supplement existing lines that are heavily overloaded. Construction of these lines was curtailed during the war years, but the areas which they served sustained a tremendous load growth during this period. The additional transmission lines are required to provide an adequate power supply to these areas.

The Bureau's plants which range in size from two of the largest in the world at Boulder Dam and Grand Coulee to some relatively small plants located on various irrigation projects are all producing to capacity. This past year saw no let-up in their service to the West; they continue to play their vital role in the development of that area. It is significant to note that the over-all trend of development of the Western States has to a very large degree followed the trend of the Bureau's activities in those States.

The postwar power program is one of great magnitude and its orderly development is of necessity scheduled over a period of years. Feasibility requirements are probably the determining factors governing the scheduling of the individual units of the whole program. Specifically, the present installed capacity of 2,439,300 kilowatts will reach a total of 4,389,700 kilowatts when installations in existing plants are completed. This total will be approximately 7,000,000 kilowatts of installed capacity upon completion of projects now under construction or authorized for construction by the Bureau of Reclamation and including authorized plants of other agencies for which the Bureau of Reclamation has been given the responsibility of marketing the power.

The fact is that a start has been made on this power program; this past year saw it gain its initial momentum. The preliminary work is well done and the way is paved for even greater progress toward its final realization in the forthcoming years. In the last analysis this power program is dedicated to the achievement of better living in the great area it is to serve. That cannot be realized until the goal of providing an abundance of low cost electric power to the widely diversified industrial and agricultural areas of the West is reached.

Design and Construction

To meet the demands of the stepped-up schedule, design work during the second half of the fiscal year reached a volume exceeding by several times that of any prewar period. A total of 845 contracts amounting to approximately $107,000,000 were awarded during the fiscal year. During the same period, 1,520 invitations to bid were issued on construction work and materials and operating equipment, amounting to $156,000,000.

At the end of the fiscal year, work on designs and specifications for authorized projects was in progress on 32 dams, 13 power plants, 52 pumping plants, and 43 major canal systems. In addition, preliminary designs and estimates were being prepared on engineering features for numerous other projects.

Construction was begun on such major works as Kortes Dam in Wyoming, first Bureau unit of the Missouri Basin project; the 160-mile Friant-Kern Canal on the Central Valley project in California; the vast irrigation system for the Columbia Basin project in Washington; and Davis Dam and power plant on the lower Colorado River. At the end of the fiscal year construction was in progress on 13 dams, 5 power plants, 19 pumping plants, and 185 miles of main canals.

The following dams were completed: Scofield and Newton Dams in Utah, Shadow Mountain Dam on the Colorado-Big Thompson project, and Box Butte Dam on the Mirage Flats project in Nebraska. Completed construction included one power plant, four pumping plants, 352 miles of transmission lines, and 87 miles of main canals, as well as the concrete lining of the 13-mile-long Alva B. Adams tunnel through the Continental Divide. First water on the Tucumcari project in New Mexico was delivered to landowners in November, quickly followed by first water delivery on the Altus project in Oklahoma, and on the Deschutes project in Oregon.

Effect of Reconversion

Construction materials and equipment shortages were reflected in the reluctance of some construction firms and manufacturers to bid on contracts involving the supply of materials. More bids than usual were rejected during the fiscal year as excessively high.

Uncertain labor supply and wages were also contributing factors to construction difficulties. However, the use of an escalator clause in many major contracts helped to alleviate the risk of labor uncertainties for construction contractors. This clause provides for increased payments to contractors in the event of approved increased wage rates. Labor supply was improved to a considerable degree in the latter part of the fiscal year by return of veterans to civilian work. Work stoppages of comparatively minor importance occurred on some projects.

With the active resumption of Reclamation peacetime construction, costs have shown substantial increases over those of the prewar period. Costs have fluctuated from a low point of 155 percent to a high point of about 200 percent of 1940 price levels. The following index ratios indicate relative increases over 1940 construction costs:

	1945	1946
Concrete dams	155	157
Earth dams	165	172
Tunnels	155	156
Canals	160	168
Laterals	163	171
Drains	170	175
Pumping plants	148	149
Power plants	130	149
Transmission lines (wood pole)	142	139

Research

Increased research activities in the Denver laboratories were directed toward the development of new and more economical materials, more practicable design, and improved construction methods. A comprehensive program of research in canal linings was started toward the objectives of improving linings and lowering construction and operating costs. In addition, the laboratories are cooperating in a broad research program of weed control. The ultimate benefits of this program to combat noxious weeds may well extend beyond Bureau project boundaries.

A soils mechanics research laboratory and a bituminous materials laboratory have been added to research facilities during the year. Preliminary plans have been prepared for the construction of 10 outdoor laboratories to permit further and more extensive research in several fields.

Engineers and technicians of the Bureau have continued to devise new methods and equipment. Bureau employees reported 26 inventions during the fiscal year.

Summary of construction results June 30, 1902, to June 30, 1946

Reservoir capacity	acre-feet	67, 897, 248
Waste-water ditches	miles	3, 143
Tunnels:		
Number		355
Length	feet	566, 521
Storage dams:		
Masonry	cubic yards	28, 025, 444
Earth and rockfill	do	55, 221, 677
Total number		100
Diversion dams:		
Masonry	cubic yards	1, 008, 232
Earth and rockfill	do	3, 259, 671
Total number		68
Dikes and levees	cubic yards	13, 277, 667
Bridges:		
Number		13, 902
Length	feet	373, 098

Culverts:		
Number		23,816
Length	feet	1,085,166
Pipe laid, length	do	12,937,155
Flumes:		
Number		6,244
Length	feet	978,492
Canals:		
Miles		15,325
Structures	number	219,670
Lined, length	miles	1,250
Power plants:		
Number		33
Capacity	kilowatts	2,178,197
Output, full year 1946	kilowatt-hours	13,172,988,997
Pumping plants:		
Number		335
Discharge capacity	cubic feet/sec	9,380
Year's pumpage	acre-feet	1,496,462
Operating transmission lines	miles	2,516
Excavation, all classes	cubic yards	625,574,739
Concrete	do	34,123,144
Cement	barrels	38,870,583

Regional Programs

The activities of the seven Bureau regional offices were greatly expanded. Coordination of activities in the major watersheds and supervision close to the field of operation has been accomplished through regionalization. A summary of important activities in each of the regions follows.

Region 1

Four major high lights featured the Bureau of Reclamation's activities in region 1, the Pacific Northwest. Water was delivered for the first time to two new projects; construction was initiated on the Nation's largest single irrigation system; reclamation farmers recorded the highest gross and per-acre crop values in history; and major strides were made in planning for a vast postwar construction program.

The Bureau's operating projects were increased by the addition of the 50,000-acre north unit of the Deschutes project in central Oregon and the 3,500-acre north unit (Post Falls) of the Rathdrum Prairie project in northern Idaho. Water was delivered to the Deschutes project on May 18, 1946, and to the Rathdrum Prairie project on June 26, 1946. The events were celebrated on both projects.

Crops produced on 13 Federal reclamation projects in region 1, which provide a full or partial supply of water to 1,792,102 acres under cultivation, were valued at $189,921,654, highest on record. The return, which was $11,800,335 more than the previous high reached in 1944, averaged $105.98 per acre, another new peak.

With the Nation calling for utmost food production, reclamation farmers in the Pacific Northwest produced huge quantities of crops in 1945, including 49,000,000 bushels of potatoes (enough to provide a year's supply for approximately 23,000,000 people), 54,000,000 bushels of vegetables, 985,000,000 pounds of fruit, 1,307,969 tons of sugar beets, and 2,276,000 tons of hay and forage crops for beef and dairy herds. Equally high yields are expected during the 1946 irrigation season.

Columbia Basin construction starts.—Construction began on the largest single irrigation development ever undertaken in the United States—the million-acre Columbia Basin project. The first contract work on irrigation facilities, which when completed will cost an estimated $355,344,000, started May 8, 1946. At the end of the fiscal year, contracts valued at $12,608,826 had been let and bids opened for additional work that will cost $2,335,651.

On July 1, excavation for the southerly 6½-mile section of the huge main canal was well under way, and companies holding awards for dams, siphons, tunnels, and for manufacturing equipment to serve the irrigation system, were preparing to start under their contracts. The Bureau's goal was to serve 6,000 acres near Pasco, at the southern tip of the project, in 1947 and 400,000 acres elsewhere in 1951.

Marked construction progress was also made at Anderson Ranch Dam of the Boise project, which when completed will be the highest earth-fill dam in the world. At the end of the fiscal year 7,300,000 of the 8,650,000 cubic yards of material of which the structure will be composed had been placed. The dam will provide supplemental water for 320,000 acres in the Boise Valley. The initial 80,000 acre-feet of storage was provided in the spring of 1946. The project's scheduled completion date is the winter of 1947–48.

Noteworthy also was the construction progress on the Deschutes project. Forty-four miles of the 65-mile long north unit (main) canal, together with laterals and sublaterals to serve 20,000 acres on the north unit during the 1946 irrigation season, were brought to completion. Primary work during the next fiscal year will include construction of the remaining 21 miles of main canal and laterals to serve 30,000 additional acres of land. Part of this new block is to be served in calendar year 1947, and the rest in 1948.

The Roza division of the Yakima project continued to make increasingly large contributions in war foods because of the rapid pace at which construction operations were carried forward. All work authorized under the war food program was brought to substantial completion. The distribution system for the last 5,000 acres of the 47,000-acre gravity unit was nearly complete at the year's end. Previously the last 10 miles of the 95-mile long main canal had been completed. Facilities to serve 25,000 additional acres by pumping from the main canal, on which construction was about to begin at the end of the year, will be substantially completed in calendar year 1947.

Construction was initiated in June 1946, on the Cascade Dam of the Boise project. It will serve 25,000 acres of new land (7,000 of which is

Government-owned and will be opened for homesteading) and also bring a supplemental water supply for 85,000 acres in the Emmett Valley.

On the Minidoka project, the Bureau planned early in the next fiscal year to begin the rehabilitation of the 70-mile long Milner-Gooding Canal and the building of laterals to serve approximately 4,500 of 18,000 acres of public land. A wasteway is to be constructed on the Owyhee project (Oregon-Idaho).

Settlement opportunities—All construction activities in region 1 were aimed at the prime Bureau objective of making settlement opportunities available for qualified veterans as quickly as possible. During the first half of fiscal year 1947, approximately 4,904 acres are scheduled to be opened to homestead entry. Approximately 3,500 acres will be served by the Milner-Gooding Canal of the Minidoka project, 1,254 acres are on the Roza division of the Yakima project, and 150 acres on the Owyhee project. With $28,973,691 in regular appropriations made available by Congress for fiscal year 1947, facilities will be brought to near completion that will supply water for more than 100,000 acres, including 30,000 acres of public land.

Work on two projects in the preconstruction stages was advanced. Investigation work, consisting principally of core-drilling and materials exploration, was in progress at Palisades Dam site in southeastern Idaho. Palisades Dam will provide supplemental water for a large block of irrigated land, a full supply for some new land, produce a sizable block of power, and aid in the control of Snake River floods. Core-drilling and building of an access road was a major activity at Hungry Horse project in northwest Montana. Hungry Horse Dam is being designed to provide storage for irrigation, power development at the site, increasing the firm output of downstream plants (including Grand Coulee Dam) and for flood control and improvement of navigation.

Project investigations.—Project investigation of potential irrigation and multiple-purpose developments received great emphasis. Forty-four widely scattered projects were under study during the year. The largest undertaking was the comprehensive investigation of water resource utilization in the entire Columbia River Basin. At the year's end the 700-page report, drafted in 1945, had been completely revised and was in the process for reproduction.

The study outlines graphically the vast resource-development potentialities in the drainage basin. A total of 238 separate projects, many of them multiple-purpose in scope, are listed. These would provide a full supply of water for 3,840,000 acres of new land and a supplemental supply of 1,520,000 acres now suffering periodic shortages.

A huge new block of hydroelectric power would be produced, including 55.6 billion kilowatt-hours of firm energy, and 9.1 billion kilowatt-hours of secondary power. New installations at 63 additional hydroelectric plants and in existing powerhouses totaling in excess of 10,500,000 kilowatts are forecast.

At 1940 price levels, the entire development program including the $1,000,000,000 transmission system would cost $3,500,000,000.

In addition to the comprehensive Columbia River report, two project investigations were completed: a 230,000-acre unit of the Mountain Home project, near Boise, Idaho; and the Lewiston Orchards project, near Lewiston, Idaho. Three reports were drafted and reviewed by agencies concerned, namely, the Palisades Reservoir project in southeastern Idaho, the Hayden Lake Unit in north Idaho, and the Yakima River channel surveys in south central Washington. A report on the Kennewick division of the Yakima project also was drafted. A basin-wide study of the Rogue River, part of the North Pacific Basin, was well advanced.

Atomic power.—In the field of power, the full scope of the great role played by the Grand Coulee Dam power plant in the prosecution of the war became known for the first time. One of the two factories producing atomic bombs was erected near Hanford, Wash., because of the abundance of power available at Grand Coulee Dam.

Including the Hanford plant, the Grand Coulee generators, together with those at Bonneville Dam, served directly manufacturing facilities with an investment of $573,850,000. These plants represented two-thirds of the total investment in war plants in the area. A substantial proportion of other plants were dependent on Columbia River power but received it through one of the private utilities.

The war industries in the Northwest were awarded $6,590,000,000 in war supply contracts. The wartime production of Pacific Northwest plants included 1,859,685,000 pounds of aluminum ingot, 370,698,000 pounds of aluminum sheet, and 23,858,000 pounds of magnesium ingot.

With the end of the war in August 1945, production of hydroelectric energy on four Bureau projects in region 1 dropped off considerably—from a gross output of 4,894,069,245 kilowatt-hours in fiscal year 1945 to 3,821,414,730 this year. Grand Coulee's plant produced 3,617,025,000 kilowatt-hours; Minidoka, 116,376,500; Boise, 62,253,900; and Yakima, 25,759,330.

Contracts were reinstated for three 108,000-kilowatt generators at Grand Coulee Dam, and bids were called for three additional 108,000-kilowatt units. When these are in operation the rated capacity of the plant will be 1,316,000 kilowatts, making it the largest in the world.

The first application for power from the proposed 40,500 kilowatt power plant at partially-completed Anderson Ranch Dam was received from the Prairie Power Cooperative, Inc., Fairfield, Idaho. It requests 100 to 300 kilowatts of energy.

Employment rises.—The increased activity in region 1 is attested to by employment totals. On July 1, 1945, some 1,773 persons were employed by the Bureau as compared with 3,765 on July 1, 1946. The regional office staff grew from 79 to 205 during the same period.

The major personnel change in region 1 was the appointment of R. J. Newell as Regional Director. Frank A. Banks, formerly Director, asked to be allowed to confine his activities to the Columbia Basin project as supervising engineer. Appointed Assistant Regional Directors in April and June 1946 were J. Lyle Cunningham and Harold T. Nelson.

Columbia Basin Committee.—With the objective of coordinating the planning, construction, and administration of multiple-purpose development programs of the Columbia River drainage basin and the coastal areas in the States of Washington and Oregon which drain into the Pacific Ocean, a Columbia Basin Inter-Agency Committee was organized in April 1946.

On the Committee are represented the Departments of Interior and Agriculture, the War Department, the Bonneville Power Administration, and the Federal Power Commission. Each of the seven basin States are entitled to a representative who serves in an advisory capacity. They constitute a link between the people of the basin and Federal agencies to insure that the local viewpoint on all problems can be given the fullest consideration.

At the end of the year plans were being made for closing the Civilian Public Service Camp for conscientious objectors on the Deschutes project. An average of 90 to 100 men were housed in the camp. The men assisted in clearing Wickiup Reservoir, puddling and priming the main canal, and with other work.

The one Japanese relocation center in region 1, situated at Hunt, Idaho, which had housed an average of 7,800 persons, was closed on October 23, 1946. This center was transferred to the Bureau of Reclamation on July 1, 1946. Some of the facilities will be disposed of to veterans who qualify for settlement of the 3,500 acres of land to be opened to homesteading during the coming fall.

Region 2

Irrigation service to more than one million acres of land, the resumption of a large-scale construction program, and electric power production amounting to nearly one and one-half billion kilowatt-hours, marked the operations of the Bureau in region 2 during fiscal year 1946. Total earnings of the Central Valley project during the year were in excess of $4,000,000. Region 2 embraces three-fourths of California and the Klamath River Basin in southern Oregon.

In the Central Valley area alone, the Bureau furnished irrigation service to 360,000 acres of land throughout the fall months of 1945 and during the early weeks of the new irrigation season in 1946 was releasing stored water for irrigation on 645,000 acres. More than 100,000 acres on the

Klamath project and nearly 30,000 acres on the Orland project also received irrigation water from Bureau-constructed works.

In the Sacramento Valley, water released from Shasta Lake was being used on approximately a quarter of a million acres during the early part of the 1946 season. In the San Joaquin Valley, releases from Millerton Lake are used on 420,000 acres. This area is covered by fifteen interim contracts providing gross revenues of $108,450 to June 30, 1946. This is about one-half the total returns expected for the entire 1946 irrigating season. Major changes in the amount of land served with irrigation water from facilities of the Central Valley project are not expected until after the Friant-Kern and Delta-Mendota Canals are placed in operation.

Large scale construction.—With the release from War Production Board restrictions early in the fiscal year, a large-scale postwar construction program was initiated. This program was based on specifications and other preliminary work accomplished during the war years. During the year, contracts amounting to more than $21,800,000 were let for construction work on the Friant-Kern, Delta-Mendota, and Contra Costa Canals, and for the manufacture of auxiliary equipment at Shasta, Friant, and Keswick Dams. The first of these major contracts was for a 6-mile section of the Friant-Kern Canal, which was placed under construction by a private contractor on September 4, 1945. Additional contracts let on the Friant-Kern Canal during the year brought the total distance under construction to 72.8 miles. A contract for the first 14 miles of the 4,600 cubic-foot-per-second Delta-Mendota Canal was awarded on June 14, 1946. During the year, construction also began on the final section of the Contra Costa Canal, including a terminal reservoir near Martinez.

In addition to major work now in progress, the construction schedule for fiscal year 1947 includes the installation of spillway drum gates at both Shasta and Friant Dams, fourteen 108-inch valves in the spillway outlets at Shasta, completion of three penstocks for the Shasta power plant, and the erection of stairways, elevators, and other miscellaneous facilities at Shasta Dam. Work is under way also on erection of 50- by 50-foot spillway gates and related work at Keswick Dam. On the Contra Costa Canal, contracts have been awarded for the construction of the Ygnacio and Clayton pumping plants and construction of these facilities is expected to begin during the latter part of 1946. No major construction work is contemplated on the Orland project but on the Klamath project construction of the 110-foot high Boundary Dam is expected to start during the early months of fiscal year 1947.

Shasta power peaks.—Operating at approximately 13.5 percent overload throughout the entire year, the two 75,000 kilowatt generating units in the Shasta power plant produced 1,486,578,600 kilowatt-hours of electric energy. The generators at Shasta Dam were used to provide part of the base load of the Pacific Gas & Electric Co., which takes the major portion of the output under a war-duration contract.

Interdepartmental sales of electric energy began on July 1, 1945, to the Delta pumping plants of the Central Valley project and to the steel pilot plant of the Bureau of Mines at Shasta Dam. The Bureau operated the Shasta substation section of the Shasta-Oroville transmission line. The remaining section of the line is under lease to the Pacific Gas & Electric Co.

On July 23, 1945, the city of Roseville signed an electricity supply contract with the Bureau for its municipal distribution system, calling for service to commerce by December 31, 1946. Extension of the Shasta-Oroville transmission line to Sacramento was authorized by the Congress and appropriations made for that purpose. Preliminary construction of the line started during the late months of fiscal year 1946. To carry out congressional mandates regarding the distribution of publicly generated power, it will be necessary ultimately to extend this transmission line to the Delta area near Tracy, Calif., to supply power service for Central Valley project pumps. However, this single 230-kilovolt transmission line cannot guarantee uninterrupted power supply without some type of standby service such as additional transmission lines or an auxiliary steam plant.

The Power Branch of the regional organization conducted economic studies for rate schedule purposes, and engaged in cost allocations and market studies during the year. In January 1946 it completed the first of a series of reports entitled "A Six-Year Advance Program of Power System Development—Fiscal Years 1947–1952."

At Shasta Dam, installation of miscellaneous power equipment and the erection of two 75,000-kilowatt generator units loaned to Grand Coulee for the actual duration of the war, began during the early months of 1946. This work will continue throughout the year with the expectation that these units will go on the line late in 1947. At the close of fiscal year 1946, the installation of miscellaneous power-plant machinery at Keswick Dam was in progress with plans in effect to continue this work throughout fiscal year 1947.

The fifth and final 75,000-kilowatt generating unit for the Shasta power plant is in process of manufacture and preliminary work in the power plant, looking forward to its installation, will be carried out during 1946 and 1947. Similar plans are in effect for installing three 25,000-kilowatt units at Keswick Dam.

Central Valley comprehensive plan completed.—Of major importance to the future development of the water resources of the Central Valley of California was the completion, on November 1, 1945, of the Comprehensive Plan for Water Resources Development—Central Valley Basin, California. During the year this report was submitted for review, as required by law, to the Governor of California and to other agencies concerned. At the close of the fiscal year the comments of the various reviewing agencies had been received and steps are being taken to prepare the report in final form for submission to the President. This report emphasizes the necessity for coordinated and integrated development of the water resources of the Central Valley. Project planning forces of region 2 are engaged and will continue to be engaged throughout the coming year in the detailed investigations necessary to amplify the comprehensive outline presented in the basin-wide study. This work points ultimately to feasibility reports on the specific features proposed in the basin report.

A similar comprehensive basin-type report for the Santa Barbara area was transmitted to the President through the Bureau of the Budget on May 16, 1946. Investigations are continuing also in the Santa Barbara area with the added specific purposes of providing a basis for a repayment contract for irrigation and municipal water facilities as proposed for construction by the Bureau of Reclamation.

After a public hearing, conducted by the Corps of Engineers, at Klamath Falls, Oreg., and Yreka, Calif., in February 1945 on their proposal to divert Klamath River water into the Central Valley, there was widespread public demand for the Bureau of Reclamation to conduct a comprehensive study of the water resources of the Klamath Basin. In June of 1946 the Bureau established a project planning office at Klamath Falls to conduct this study. At year's end it was in progress and, due to the complexities of water distribution problems in the Klamath Basin, may take more than 3 years to complete.

Water storage benefits.—During the 1945-46 rainy season, storage in Shasta Lake reduced the flow of the Sacramento River at that point from 100,000 to 5,000 cubic feet per second, thus making a substantial contribution to flood protection on the lower reaches of the river. Stored water released from Shasta Lake produces power, aids in the propagation of salmon and other fish life, irrigates nearly a quarter of a million acres of crops along the Sacramento River, maintains a flow sufficient for navigation, furnishes the major portion of the flow necessary to prevent ocean water encroachment on 450,000 acres of rich Delta land, and via the Contra Costa Canal, supplies farms, large industries, and municipalities along the south shore of Suisun Bay.

For the second successive season, water passed the spillway crest of Friant Dam. Pending completion of the Delta-Mendota Canal, water from the Millerton Lake is used to satisfy the Miller and Lux exchange contract, furnishes water on an interim basis to 420,000 acres and via the Madera Canal delivers water for ground-water replenishment in the Madera irrigation district.

Water contract signed.—On October 18, 1945, the board of directors of the Southern San Joaquin municipal utility district signed the first water contract ever consummated under the provisions of section 9 (e) of the Reclamation Project Act of 1939. This contract provides for the delivery of a maximum of 91,000 acre-feet of class I water and 33,000 acre-feet o class II water annually from the Friant-Kern Canal. Contract negotiations with three additional districts were in advanced stages on June 3 1946, and negotiations, including studies of irrigation distribution system are in various stages of completion with nine other districts in the Friant Kern Canal service area.

The Contra Costa Canal was operated during the year to deliver 11,59 acre-feet of water under an interim contract which returned a revenue o $43,450, an amount sufficient to cover operation and maintenance costs In the absence of an irrigation distribution system, 7 percent of this wate was used for agricultural purposes from canal-side pumping, while 78 percent was consumed by industries and 15 percent by municipalities. Negotiations for a permanent contract including arrangements for irrigation distribution systems are currently in progress with directors of the district

During the year a wide range of studies including 1945 crop surveys, weed surveys, analyses of excess land holdings, consumptive use studies, preliminary water requirements, land classification, cost allocation studies, and related investigations were completed in preliminary stages and most of them will be carried forward on a more deailed basis during the ensuing year on present and proposed projects within the region.

Of primary importance to the Central Valley project was the cost allocation study, which was in an advanced stage of completion at the end of the year.

Region 3

The Bureau's hydroelectric plants on the lower Colorado River, producing about half of the power generated on all Bureau projects, continued to make region 3 the "powerhouse" of the Southwest. Water used in the generation of power was reused to irrigate hundreds of thousands of acres served by Reclamation facilities.

Having supplied about half of the power needs of the Los Angeles metropolitan area during the war years in addition to serving areas in Arizona and southern Nevada, power generated by Boulder and Parker Dams is now playing an equally important part in the Southwest's reconversion program. The Salt River Valley, Yuma Valley, Imperial Valley, and other irrigated areas served by Reclamation facilities are continuing their high rate of production, established during the war, to help bolster the Nation's short food supply.

The Boulder and Parker power plants, and a small plant on the Yuma project, generated a total output of about 5⅔ billion kilowatt-hours during the fiscal year 1946. Crop production for the calendar year 1945 from 741,843 acres served by Reclamation facilities was valued at $111,509,257, about the same as for the previous year.

On VJ-day the Bureau was given the "green light" to proceed with projects held up by the war. The construction program on projects in this region was accelerated. Construction of Davis Dam, 67 miles downstream from Boulder Dam, was officially begun April 19 by the contractor, the Utah Construction Co. Construction of irrigation systems and predevelopment of land on the Gila project near Yuma, Ariz., and extension of the Coachella Main Canal in southern California, were accelerated.

Davis Dam.—Contract for construction of Davis Dam and powerhouse, largest Colorado River project since the completion of Boulder Dam in 1936, was awarded to the Utah Construction Co. in January at a contract price of $21,462,505. Total project cost, including generating machinery and transmission system, is estimated at $77,000,000. A construction camp has been established at the damsite and more than one thousand construction workers are now actively employed. The construction period will extend over 3½ years.

Primarily designed as a power project, Davis Dam will also provide regulation of the river flow below Boulder Dam for the benefit of irrigated areas in this country and Mexico, together with incidental benefits to wildlife and recreational interests.

The Davis Dam power plant will have an installed generating capacity of 225,000 kilowatts, bringing the region's hydroelectric capacity to more than 1⅓ million kilowatts and adding from three-quarters of a billion to a billion kilowatt-hours annually to the present output along the river.

Transmission systems.—The second Parker-Phoenix 161-kilovolt line was completed, except for relay protection, and was placed in operation on a temporary basis.

Contracts covering major items of terminal equipment for the Parker-Gene 230-kilovolt interconnection were awarded. The interconnection, scheduled for completion during the next year, will provide an additional 90,000 kilovolt transformer bank to the present tie between the Parker and Boulder transmission systems.

Coachella Main Canal.—This vital water artery, which will irrigate some 75,000 arable acres of land in the rich Coachella Valley of southern California, is expected to be completed sometime in 1948. Almost 90 percent of the 145-mile-long canal, which is a branch of the All-American Canal System, was completed or under contract.

The Coachella Valley County water district currently is considering a supplemental repayment contract for the construction of a distribution system to serve the valley. The contract would authorize the Bureau to request funds from the Congress for the construction of a distribution system. Emphasis is upon the early relief of the present planted acreage in the valley for which the existing water supply from underground sources is inadequate.

Gila project.—On the Yuma Mesa division of this project, over 6,000 acres of land are leveled. Some 3,500 acres are planted to alfalfa or to a nurse crop. The Yuma Mesa division contains about 40,000 acres of land in public ownership which will be made available for homestead entry at a future date. About 10,000 acres of public land are slated for initial settlement by veterans late in 1947.

On the Gila project, ditch test sections were prepared by oil treatment as a part of the experimental work in seeking means by which water losses in farm ditches may be reduced. Plans were made during the last quarter of the fiscal year to extend this activity and, under a joint program sponsored by the Branches of Operation and Maintenance and Design and Construction, to determine the most economical methods for preventing water losses in canals, laterals, and farm ditches.

East Mesa.—Land classification surveys on East Mesa, All-American Canal System, were continued and a final report was prepared. Preliminary negotiations with the Imperial irrigation district regarding a distribution system for 10,000 acres were begun. This area will serve as a full-scale trial or demonstration of the agricultural possibilities of the mesa soils.

Yuma project.—Plans were largely completed for connection of the Bard irrigation district, reservation division, laterals to the All-American Canal. Construction of these connections will be under way early in the fiscal year 1947. The connections will provide greater operating flexibility for the lower Colorado irrigation program and will permit the opening of Laguna Dam for sluicing silt and sand deposited between Imperial and Laguna Dams by the desilting works. Laguna Dam thus will become an operating adjunct of Imperial Dam and a part of the All-American Canal System. Work was initiated to establish the factual basis of recommending a rehabilitation program for the Yuma project.

The soil and moisture conservation program on the Yuma project was continued, activities consisting mainly of the accumulation of additional information regarding ground-water levels in relation to the volume of water diverted into the canal and lateral system. The program for the fiscal year 1947 was formulated with special emphasis on the possible influence of irrigation of the new lands of the Yuma Mesa of the Gila project on the valley lands of the Yuma project and the South Gila irrigation district. The grid of observation wells will be increased in number, and the work will be carried on jointly by the superintendents of the Yuma and Gila projects and coordinated by the district engineer.

Weed control.—On both the Yuma and Gila projects, an intensified program of weed control was launched. Systematic burning of weeds along canal banks of the Yuma project will be continued throughout the fiscal year 1947. The use of oil spraying and new chemical methods of weed control, separately and together with burning, was investigated on the Yuma project.

On the All-American Canal project, the regional weed-control specialists assisted the project forces in establishing an effective program for the removal of the vegetative growth in the All-American Canal.

Present plans for the rehabilitation and maintenance work in the All-American Canal upstream as far as Pilot Knob wasteway will be effected by December 1946.

Colorado River Basin Report.—Regions 3 and 4 are jointly responsible for completing a comprehensive report entitled "The Colorado River, 'A National Menace Becomes a National Resource.'" This report inventories water and other resources in the Colorado River Basin, summarizes the present irrigation, power, and municipal uses of water of the Colorado, and presents future developmental possibilities for the use of Colorado River water for irrigation, power, municipal supply, and other beneficial purposes. The report describes 134 projects, or units of projects, which could be developed in the natural drainage basin of the Colorado River and recognizes that additional potential projects outside the Basin could be supplied by the exportation of Colorado River water. The construction cost of the 134 projects, or units of projects, is estimated to be 3½ billion dollars based on present prices. The possibilities for use of water exceed the water supply. The report therefore suggests that the States concerned recommend a group of projects which will fall within the ultimate allocable supply available and that the States mutually settle upon their respective rights to Colorado River water.

Sub-basin and project reports.—Region 3 has been preparing sub-basin reports on the Virgin, Little Colorado, and Muddy Rivers and recently started investigations in the Upper Gila sub-basin, New Mexico. Reports on nine comparatively small irrigation projects in Utah, Nevada, and Arizona were in the course of preparation; on two of these, preliminary drafts have been circulated. In addition, engineering field studies were made of a combined intake for the Palo Verde irrigation district and a possible Palo Verde Mesa irrigation project, California. A preliminary report was prepared, and circulated, of costs and route to be followed to furnish San Diego, Calif., with Colorado River water from the All-American Canal.

Central Arizona project.—An important cooperative investigation, the Central Arizona project, in which Arizona matches funds to the extent of $200,000, is being carried on to study the furnishing of Colorado River water as a supplemental supply to about 600,000 acres in the valleys of the Gila and Salt Rivers near Phoenix, Ariz., where excessive pumping has depleted the ground water supply and where the lack of water has become a serious threat to this highly developed area.

A comparison report, distributed in preliminary form in October 1945, reduced the consideration of possible feasible aqueduct routes from three to two. Since then, there has been in the course of preparation an interim report taking up the furnishing of Colorado River water to central Arizona from a diversion at the potential Bridge Canyon Reservoir. From th reservoir, water would be conveyed through the potential Big Sandy Tunnel, about 80 miles long, then in an aqueduct 248 miles long to the potential McDowell Reservoir on Salt River east of Phoenix. If Bridge Canyon Dam is built, silt storage will be needed on the Colorado River system upstream. A start has been made toward investigating a silt storage reservoir at the Coconino site on the Little Colorado River.

A second interim report will cover investigation of an aqueduct tha would supply Colorado River water to central Arizona from Havasu Lak above Parker Dam. In this case water would be elevated about 1,00 feet by pumping to the aqueduct, then carried about 235 miles to Granit Reef Reservoir on Salt River east of Phoenix.

River control.—The regional office of river control was established fo the primary purposes of formulating and executing plans for physical control of the Colorado River and its tributaries within the region, to contro and apportion the water of the river according to intended functions, and to handle administrative problems arising under the Mexican treaty.

The regimen of the river has been and will continue to be altered by the construction of Boulder, Parker, and other dams. This fact has introduced many difficult problems. The silt-bearing river, deprived of its silt, issues clear below the dams in a channel previously adjusted through the ages to accommodate silt-laden water. Under such circumstances it is a natural phenomenon for the clear river to strive to recharge its silt load and to adjust its alignment and grade for restoration of the natural characteristics. The river bed further downstream becomes unstable with an increased tendency to meander, raising the elevation of the river bed and forcing the deposition of silt to progress upstream until a new balance is reached.

The "Needles situation," over the entire 12-mile section of the river from Needles to Topock, is an example of this building up of the valley floor. Emergency measures to control this situation are now in progress. Permanent correction of the situation has been provided by an act to amend the laws authorizing the performance of necessary protection work between the Yuma project, near the Mexican border, and Boulder Dam, some 300 miles up the river. This act was signed by the President during the latter part of June 1946. While this act authorizes the Bureau to perform the work necessary for the permanent alleviation of this section of the river, it makes no appropriation of funds.

Specifications were prepared for the proposed dredging of the river channel at Needles. These specifications will be formally advertised during the next year.

Emergency measures at Needles consisted of the raising of the protecting levee to within about one foot of its designed grade, the placing of riprap along the riverward face at critical sites, and the continuous pumping of seepage water from the affected areas in the outskirts of the city.

To penetrate the dense swamps of tules, willows, cottonwood trees, and other vegetation in the valley sections of the river, Bureau survey parties are now using amphibious vehicles officially known as the Mark 3 landing vehicle (LVT–III). These amphibians, like those that stormed the beaches of the southwest Pacific in the latter months of the war, carry the surveyors to points in the swamp which previously were almost inaccessible. In addition, surplus walkie-talkie two-way radio sets are being used by the surveying parties to maintain constant contact.

In addition to the physical control of the river bed, the office of river control administers the control of water, which is necessary for the conservation of supply and achievement of maximum benefits. This control includes the dispatching of water required for irrigation, flood control, navigation, domestic use, power generation, and fulfillment of the Mexican treaty obligations, as controlled through release of reservoir storage and balanced against the available supply.

The control of water begins with forecasting the supply which will be available. To this end, investigation of forecast methods has been carried on. Forecasts of inflow to Lake Mead have been made by this office during the years 1945 and 1946.

As the 1946 snow run-off season on the Colorado River approached, it was apparent that inflow to Lake Mead would be far below normal. Accordingly, beginning with June 1, 1946, the start of the new power contract year, releases from Boulder Dam were reduced to the minimum necessary to satisfy downstream demands for irrigation and other uses. A system of careful daily scheduling of releases from Boulder and Parker Dams for 1 week in advance was initiated, in order to reduce run-off to the Gulf of California to a minimum. Such a system of scheduling must be followed in years of water shortage. In years of excess run-off, on the other hand, when flood waters must be accommodated, it will also be necessary to schedule releases carefully. The problem then will be to provide storage space for future floods, at the same time keeping the flow low enough to avoid damage to lands along the river.

San Diego aqueduct.—The 71.5-mile San Diego aqueduct was originally planned and financed as a war measure to provide a supplemental water supply from the Colorado River for the naval installations and war industries in the San Diego area, and the war-swollen population drawn into that area by these activities. Preconstruction surveys by the Bureau of Reclamation were completed in June 1945, plans and specifications were prepared in the Chief Engineer's office, and the last of the seven contracts into which the job has been divided was awarded by the Navy in November.

Following VJ-day immediate cancellation of all these contracts, threatened by the Navy, was averted only by the signing of a contract by the city of San Diego agreeing to repay the Navy over a 30-year period the entire construction cost. Work under all contracts is now in progress under Navy supervision, with the Reclamation Bureau as consultant assisting in inspection of field work and review of ship drawings and proposed changes of construction plans to fit field conditions.

Lower Colorado River district.—As of June 1 the lower Colorado River district was established with a district engineer at Yuma in administrative charge, under the Regional Director, of Gila project construction, Gila project operation and maintenance, Yuma project operation and maintenance, and Imperial division, All-American Canal, construction and operation and maintenance. Simultaneously, the Coachella division, All-American Canal, was established as an autonomous project, under a construction engineer reporting administratively direct to the Regional Director.

Region 4

The transition from war to peace in region 4 during fiscal year 1946 was marked by the need of expanding the investigation and construction programs in the face of continued war scarcities including housing, equipment, and materials of all kinds; the necessity for new economic studies in connection with the new crops and crop values developed during the war, and the detail work of negotiating amendatory repayment contracts to match the increased costs of construction and the changed economic status of existing irrigation projects.

Under War Production Board and War Food Administration priorities, the Scofield, Utah, and Newton, Utah, projects were continued to completion approximately as planned. Some work was accomplished by the Bureau on the Mancos, Colo., project with the help of a Civilian Public Service camp, but since February 1946 little has been done pending authorization of new funds.

As the labor situation improved, activity increased on the Provo River project, Utah, where employment of 61 additional employees increased total personnel to 143. Construction of a 10½-mile section of concrete pipeline for the Salt Lake aqueduct was finished, bringing to completion 27 miles of the 40-mile conduit that will carry water to Salt Lake City and surrounding area. Eighty percent of the excavation for the enlargement of the Provo Reservoir Canal was accomplished and the last of the siphons, except the Jordan Narrows siphon and pumping plant, were installed in the canal line. Work was nearly completed on the Weber-Provo Diversion Canal with the construction of several irrigation structures and the placing of concrete lining in some sections, leaving 4,000 feet of concrete lining as the only work yet to be done on the canal. Work has not yet been resumed on the 6-mile Duschesne Tunnel, nearly half completed in 1942 when a War Production Board order halted construction.

Completion of the dams for the Newton and Scofield projects during the year brings the number of reservoirs in the region to a total of 16, with an aggregate active capacity of 2,125,000 acre-feet of water. These reservoirs, together with natural flow for direct use, supplied irrigation water to 16 operating projects, the Provo River and the Scofield projects being operated during construction.

Crop production up.—For the calendar year 1945, during which water supply conditions were favorable, 486,600 acres in cultivation produced crops valued at $38,120,000. This represents an increase of $3,420,000 over calendar year 1944. In addition, some water was delivered and crops were grown under the old privately constructed irrigation systems on the Mancos and Eden projects where construction of dams had been commenced by the Bureau, but suspended during the war.

Alfalfa and grains maintained their position as top producers on irrigated lands in region 4 and are important crops to the livestock and dairy industries of the intermountain area. Potatoes, sugar beets, truck crops, and fruits are gaining in favor.

The ability of the Bureau reservoirs to furnish domestic and industrial water supplies as well as irrigation water will continue to be an important factor in the industrial development of the region. Transfer of the Geneva steel plant, which receives water from the Provo River project, from Government to private ownership with assurance of continued and increased operation of this industry gives promise of industrial expansion and growth for the intermountain area.

Bureau reservoirs continued to plan an important role in providing recreational facilities for the intermountain area. Many of them are near relatively thickly populated areas and provide boating, swimming, and fishing activities while others are more remote, but make up in scenery and excellent fishing for the extra distance that must be traveled to reach them. Thousands of vacationists have enjoyed the facilities afforded, and indications point to the growing importance of, and necessity of planning for, reservoirs as recreational areas.

Reclassification survey.—A detailed land reclassification survey and economic study on 130,000 acres of the Uncompahgre project was completed as was a detailed land classification of the Lyman project, Wyoming, and semidetailed land classification of the Malad, Idaho, and South Cache, Utah, projects. Reconnaissance land classification of the Upper Gunnison project, Colorado, and semidetailed land classification of the Glendale-Mapleton project, Utah, and Bear River project, Utah, Wyoming, and Idaho, were planned for completion within the fiscal year 1947. In addition, economic surveys for the Ogden and Provo River project areas are in final stage. These surveys to determine the water users' repayment ability will furnish a basis for consideration of amendatory repayment contracts which are expected to be negotiated during the ensuing fiscal year.

An active weed control program has been developed cooperatively with Federal, State, and private agencies. Concurrent research programs to develop technical information and determine adaptibility of new chemicals and new procedures to weed work were instituted at the same time.

Total personnel increased from 302 to 638 during the year. Most of th increase was required to initiate peliminary investigations of potenti projects and to accelerate schedules delayed by loss to war work of me trained in reclamation planning. Forty-one employees returned fro military furlough and approximately 70 percent of other additions wer veterans. Field offices were expanded at Logan and Vernal, Utah; Carso City, Nev.; Durango, Grand Junction, and Gunnison, Colo. New office were opened at Kemmerer, Wyo., Steamboat Springs, Colo., and Spanis Fork, Utah. The Provo River project office nearly doubled and plan were made for the early establishment of Bureau offices at Naturita, Colo and Ogden, Utah, with still other localities under consideration as site for offices yet to be set up.

River Basin studies.—Basin-wide studies, designed to formulate a patter for the greatest ultimate development of the three major drainage basins i region 4, were completed during the year and reports completed or nearl so far all three basins. The Colorado River report, written in cooperatio with region 3, and covering some 134 potential projects, project extension or other important units, was approved June 7, 1946, and submitted t reviewing agencies. The Bonneville Basin report, including approximatel 25 potential developments, has been completed in draft form. The Lahontan Basin report covering approximately 20 potential projects was nearing completion at the close of the fiscal year.

Detailed surveys of specific projects will command principal attention in the region for the next year. A report on the Paonia project, Colorado, has been submitted to the Governor of Colorado, to the Secretary of War, and to the Federal Inter-Agency River Basin Committee. Reports on the Hammond project, New Mexico, and the Gooseberry project, Utah, have been completed in draft form. Other projects upon which reports are nearing completion include: Malad Valley project, Idaho; Silt, West Divide, Fla.; Dolores and Pine River Extension projects in Colorado; La Plata project, Colorado-New Mexico; Emery County, Jensen, and Vernal projects, Utah; and the Lyman project, Wyoming. Detailed investigations are also under way on about 20 other projects.

It is expected that the way will be cleared in the near future for resuming construction on the Mancos, Colo., and Eden, Wyoming, projects which with the Provo River project and a small amount of work to complete the Ogden River project will make up the construction program for the next fiscal year.

Power investigations.—Power, as an aid to irrigation and industrial development, is becoming of increasing importance and, of the many possibilities in region 4, the Diamond Creek, Echo Park, and Truckee-Carson potentialities have been chosen for detailed investigations during the following year. Population growth and industrial expansion in region 4 continues at a rapid rate. Development of multipurpose projects to provide t the earliest possible moment the two major needs (irrigated farm homes nd electrical energy) has become a necessity.

The 1,690-acre Pitt Ranch on the Humboldt River, purchased by the Government during acquisition of water rights was sub-divided and disposed of during the year. Thirty-five right-of-way purchase contracts were ompleted on the Provo River project and new or renewal leases for Bureau-owned or controlled lands were executed on approximately 21,000 acres.

The heavy demands for equipment, materials and supplies were met without serious delays despite critical market conditions in general. Old Civilian Conservation Corps buildings were converted into housing units at two locations and 51 Federal Public Housing Authority units were obtained for a housing project in western Colorado; 22 house trailers were purchased to alleviate the housing shortage; surplus property proved an excellent source of supply for critical items.

Material on Reclamation's role in conservation of natural resources was prepared at the request of the Utah Department of Public Instruction, for inclusion in their manuals for the seventh grade, twelfth grade, and adult classes.

Region 5

Six projects were in operation or under construction in region 5 of the Bureau of Reclamation at the end of fiscal year 1946. Nine river basins, three important subbasins, and 24 projects were under investigation, and reconnaissance or preliminary study was being made of 18 projects. Land development programs were in progress on two projects under construction. Transmission systems were fanning out from Elephant Butte Dam, delivering 109,361,526 kilowatt-hours of energy and bringing in revenue amounting to $359,226.

Highlights of the year were: opening of the new Balmorhea, Tex., project; dedication of the Lugert-Altus Dam near Lugert, Okla.; and formation of an irrigation district at Canton, Okla.

First contract for the Balmorhea project was awarded June 19, 1946. The project is designed ultimately to provide supplemental water for 7,400 acres now receiving an inadequate supply, and a full water supply for 3,260 acres of new land.

The Lugert-Altus Dam was dedicated at an impressive ceremony on January 30, 1946. It is a concrete gravity-type, partially curved structure rising approximately 100 feet above the North Fork of the Red River, and has a crest of 1,160 feet. The reservoir, with a capacity of 163,000 acre-feet, impounds water for the ultimate irrigation of between 60,000 and 70,000 acres in the Lugert-Altus irrigation district.

Landowners along the North Canadian River in Oklahoma voted December 4, 1945, to form the Canton irrigation district of 21,710 acres in the area from Canton to Karns Spur. The vote was 96 to 42. Final draft of the Canton project report is in the process of reproduction.

Major activities of region 5 during the 1946 fiscal year are outlined in the following reports of various branches and divisions.

Construction.—Five projects in region 5 are now under construction. These comprise: Tucumcari, N. Mex.; Altus, Okla.; Balmorhea, Tex.; Rio Grande (storage and power division only); and Marshall Ford Dam on the Colorado River of Texas.

Water for the Tucumcari project is obtained from the Conchas Reservoir on the South Canadian River, and is brought to the irrigable 45,000 acres by a canal of total length of 77.3 miles. The project is 68 percent complete, with expenditures amounting to $9,493,000. A total of 56 miles of the Conchas Canal has been completed, and irrigation is now available for the first 6,672 acres. Five tunnels and 33 concrete siphons are in the canal system.

The Lugert-Altus Reservoir on the North Fork of the Red River provides water for the Altus project. The dam is 99 percent complete. The main canal and a portion of the Altus Canal are complete, and irrigation of the first land is under way. The project is 57 percent complete, with total expenditures of $6,809,170. The project includes 52,000 net acres of irrigable land. Work is under way on the Altus Canal, the West Canal, Altus City pipe line, and the Altus Blair and West laterals and sublaterals.

First contract for the Balmorhea project was awarded June 19, and construction is expected to start during July 1946. Expenditures to date total $38,000. The project is 10 percent complete on a cost estimate.

The storage and power division of the Rio Grande project is approximately 86 percent complete. Expenditures to date total $10,314,645, and the cost of work yet to be performed was estimated originally at $1,748,000. Remaining work includes construction of transmission lines to Alamogordo and Hollywood, N. Mex., and from Elephant Butte Dam to Socorro and Albuquerque, N. Mex. Spillway repairs will be made on Elephant Butte Dam at an estimated cost of $150,000.

Expenditures on the Marshall Ford Dam to date total $23,914,209. This structure will be turned over to the Lower Colorado River Authority in the near future in accordance with the contract of 1941. Remaining work will be performed with $68,400 appropriated by the Congress for 1947.

Authority was delegated in January 1946 to the Design and Construction Branch to prepare preliminary designs and cost estimates for project planning feasibility reports, and this work was carried out as authorized on the Canton, Okla., and Hudspeth, Tex., projects. Reviews of project reports with reference to design features and cost estimates have been made for the Robert Lee, San Angelo, Fort Sumner, and Balmorhea projects. Special reports were completed for the Carlsbad project and Guadalupe Basin Report. These reviews included an analysis of 1940 and present day construction costs, and a review of design and construction features with recommendations.

Scheduled work.—The major part of the Tucumcari project is scheduled for completion in the 1947 fiscal year, with remaining lateral construction work and drainage extending into 1948. An expenditure of $4,462,332 is planned in 1947 and 1948 to complete the project. All funds are now available for use.

The Altus project is scheduled to be completed by end of the middle of 1948. Future work will include construction of the Ozark canals, Ozark laterals and sublaterals, and drainage work. Appropriation for the remaining work total $5,091,610.

Completion of the storage and power division works in the Rio Grande project area is scheduled to be completed during fiscal year 1948.

Work remaining on the Colorado River project, Texas (Marshall Ford Dam) includes the purchase and installation of a gantry crane and a standby generating unit, road repair, painting of damaged areas and miscellaneous work all to be completed in 1947.

All work on the Balmorhea project is scheduled for completion in the 1947 fiscal year when the remaining $342,000 of the total estimate cost of $380,000 will be expended in the construction of Phantom Lake Canal and the Inlet Feeder Canal. These canals are expected to deliver water by November and December 1946, respectively. Expenditures to date total $38,000.

Plans are being developed for the possible start of construction work in the 1948 fiscal year on the San Luis Valley, Valley Gravity, Fort Sumner, and Canton projects.

Planning developments.—Planning work for water resources development included investigation of 9 river basins, 3 important subbasins, 24 projects, and reconnaissance or preliminary study of 18 projects. In addition, detailed surveys and preparation of construction plans were in progress for 3 projects.

Drafts of reports on the Nueces and the Rio Grande Basins, and the Middle Rio Grande project have been completed. The close of the fiscal year also found final drafts of the Canton, Robert Lee, and Balmorhea project reports in the process of reproduction.

Preliminary reports have been prepared on the Fort Sumner and Tucumcari water supply projects.

During the first quarter of the fiscal year 1947, it is expected that reports will be completed for the Canton, Robert Lee, Balmorhea, San Angelo (North Concho), Fort Gibson Reconnaissance, and Hudspeth projects, the Guadalupe and Arkansas River Basins, Rio Grande project recreation and Carlsbad project recreation. During the second quarter, completion of reports is scheduled for the Fort Sumner, Mud Creek Reconnaissance, and San Luis Valley (Conejos division) projects.

In the third quarter, reports are scheduled to be completed for Capulin Reconnaissance, Valley Gravity, Englewood and San Luis Valley (Rio Grande division) projects, and for the Washita River subbasin. During the fourth quarter, reports are to be completed for the Black Mesa Reconnaissance, Mora Reconnaissance and Kenton projects, and for the Pecos River subbasin.

Major operation and maintenance activities were confined to four projects in operation or under construction.

Rio Grande project.—Some 154,862 of the 178,073 acres in New Mexico and Texas in the project area were irrigated in 1945. The 6,518 irrigated farms in the area had a population of 33,060. Gross crop returns for 1945 were $22,389,974, an average gross return of $144.58.

Carlsbad project.—One of the oldest irrigation projects in the Western United States, the Carlsbad project is in critical need of rehabilitaton. An economic study is being conducted as a basis for definite plans to accomplish this restoration. The project embraces 25,055 acres in the Pecos River Valley of New Mexico. Drouth increased the water shortage problem in 1945 when 20,715 acres were under irrigation. There were 459 farms in the area, with a population of 1,954. Gross crop returns were $1,539,966, an average of $74.34 an acre; a decrease of $300,000 and $13, respectively, over 1944 returns.

Altus project.—Irrigation facilities to serve approximately 1,300 acres of project lands were completed by June 30. When completed, the Altus project will contain approximately 55,000 acres of irrigable land. Dryland farming on 71,167 acres in the area resulted in gross crop returns of $1,631,297 for 1945, an average of $24.59 per acre. There were 512 farms in the area with a population of 996.

Tucumcari project.—Land development work has been done on 3,899 acres of the 45,000-acre project, and 1,544 acres have been smoothed for irrigation. An estimated 900 acres of wheat and 40 acres of alfalfa were planted in the fall on developed irrigable land. This was irrigated in the spring, and a good stand of wheat was secured. The project was not operating at the close of 1945, and lack of preirrigation data prevented the compilation of a crop and livestock report.

The 1947 program is designed to help farmers solve important problems in connection with the first use of irrigation water. The program includes: advising in the use of water; predevelopment of farm land, advice on farm management, completion of farm unit studies for use in directing settlement, and water duty studies for scheduling economic consumption and delivery of water.

Power facilities.—A 115,000-volt transmission system from Las Cruces to Alamogordo Air Field, N. Mex., was completed last year. The 70-mile line was built for delivery of power to Alamogordo Air Field and the White Sands Proving Ground.

The Bureau's power facilities for region 5 consist of a hydro-generating plant at the toe of Elephant Butte Dam and transmission system. The Elephant Butte plant consists of three 8,100-kilowatt generating units with an estimated annual salable output of 107,000,000 kilowatt-hours. Total energy delivered for the fiscal year 1946 was 109,361,526 kilowatt-hours, with an electric revenue of $359,226.92. Power has been allocated equally for use in New Mexico and Texas. Two hundred and twenty-five miles of transmission lines are used to market the power over the area of southern New Mexico and El Paso, Tex.

The transmission system consists of the following lines: Elephant Butte to Deming, N. Mex., for delivery of power to the Deming Ice & Electric Co., 76.20 miles, 115,000 volts; Deming to Central, N. Mex., for delivery of power to the Community Public Service Co., 42.32 miles, 115,000 volts; Elephant Butte to Hot Springs, N. Mex., for delivery of power to the town of Hot Springs, 3.75 miles, 13,800 volts; Elephant Butte to Las Cruces, N. Mex., 63 miles, for delivery of power to the El Paso Electric Co.; Las Cruces to Alamogordo, 70 miles, 115,000 volts.

The following transmission lines are under construction or authorized: Alamogordo Air Base to Hollywood, N. Mex., for delivery of power to Community Public Service Co. at Alamogordo and Hollywood and Otero County Electric Cooperative at Alamogordo and Hollywood, 55 miles, 115,000 volts; Elephant Butte to Albuquerque for delivery of power to Socorro Electric Cooperative at Socorro, N. Mex., Community Public Service Co. at Socorro and Albuquerque Gas & Electric Co. at Albuquerque, N. Mex., 150 miles, 115,000 volts.

Proposed additional plants include El Vado, 10,000 kilowatts scheduled in 1949; Chamita, 15,000 kilowatts in 1950; and Abiquiu, 15,000 kilowatts in 1953. These plants will be located in the north central part of New Mexico on the Rio Chama.

Region 6

The Flood Control Act of 1944 approved the comprehensive plan of the Bureau of Reclamation and the Corps of Engineers for the conservation, control, and use of the water resources of the Missouri River Basin, and contained authorization for the construction of its initial stages.

During fiscal year 1946, the activities of region 6 have been largely concentrated on work required to bring the first six authorized units up to the construction stage, including the preparation of construction plans and specifications, and this work has been practically completed for the following units:

The Boysen Reservoir on the Big Horn River in Wyoming will store 820,000 acre-feet. A power plant at the dam will have an installed capacity of 15,000 kilowatts. The reservoir will provide flood control for lands along the Big Horn River and will afford immediate silt control. Stored water will be used as insurance for existing water rights on the Big Horn River in Wyoming and Montana and on the Yellowstone River below the mouth of the Big Horn when additional irrigation is developed in either or both basins. Contracts have been awarded for the erection of an engineer's camp and construction of a transmission line to supply power for construction. Bids have been opened for the reconstruction of 4½ miles of United States Highway 20.

The Owl Creek unit, in Wyoming, consists of the Anchor Reservoir, which will provide 14,500 acre-feet of storage, and the Lucerne pumping plant which will provide water by pumping from the Big Horn River, both to be used as supplemental water for 14,400 acres in the Owl Creek Valley now inadequately irrigated. Plans are complete.

The Angostura unit on the Cheyenne River in South Dakota will provide water for 16,000 acres to be served by gravity, and 25,000 acres to be served by pumps. Storage of 92,000 acre-feet will be provided by Angostura Reservoir which will also serve as a diversion dam. Bids for the construction of this dam have been opened.

The Tiber Dam on the Marias River in Montana will store 340,000 acre-feet and divert water for the irrigation of 120,000 acres on the north side of the Marias River. Plans and specifications for the Tiber Dam are nearly complete. Topographic surveys and land classification of project lands are under way.

Plans and specifications for the Canyon Ferry Dam on the Missouri River near Helena, Mont., are complete. The reservoir formed by this dam will have a capacity of 2,000,000 acre-feet. It will be used to insure protection for all water rights in the upper Missouri Basin, both above and below the reservoir when additional irrigation development is undertaken. A power plant of 36,000 kilowatt capacity will be provided.

Plans and specifications for the Heart Butte Dam on the Heart River in North Dakota are complete. The reservoir formed by this dam will provide storage of 300,000 acre-feet, of which 55,000 acre-feet will be available for the irrigation of 13,500 acres to be served partly by gravity and partly by pumping. Also included in the Heart River unit will be the Dickinson Reservoir, which will provide storage of 7,000 acre-feet, partly for municipal use at the town of Dickinson and partly for irrigation by pumping.

In addition to the above, plans and specifications are nearly completed for the Savage pumping unit in eastern Montana, which will serve 2,390 acres, and for the Square Butte and Wogansport pumping units along the Missouri River in North Dakota, to provide water for 3,500 acres.

Surveys and investigations.—During the fiscal year, surveys have been in active progress to obtain data for the preparation of plans and specifications for the Missouri-Souris unit, including the Cheyenne River Dam in Montana and North Dakota; the Hardin unit, including Yellowtail Dam, in Montana; the Grand River and Knife River units, and pumping units in North Dakota, and Paintrock unit in Wyoming.

Reconnaissance work has been in active progress at a number of points in the region, including the proposed diversion from Garrison Reservoir in North Dakota.

Contracts have been awarded to provide topographic maps to be used as a basis for further investigations of the Tongue, Clarks Fork, and Powder River Basins. Another contract covers aerial photography of irrigable lands in the Grand River Basin, N. Dak., Missouri-Souris unit, Montana and North Dakota, the Teton Basin in Montana, and Tongue and Powder River Basins in Montana and Wyoming. Rectified aerial photographs on a scale of 1 inch to 400 feet will be used as a basis for detailed land classifications and topographic surveys. Aerial topography has already been secured for the Yellowtail Reservoir site in the Big Horn River Canyon and for the canal line location between Tiber Reservoir and the project lands on the Lower Marais unit. Aerial photographs of the project lands under the Lower Marais unit have also been procured.

The Intake project, near Glendive, Mont., was constructed during the fiscal year and is being operated, for the first time, in 1946.

Deerfield Reservoir, the major feature of the Rapid Valley project, is practically complete. Water was being stored, at the end of the year, for supplemental supplies for lands irrigated in the Rapid Creek Valley, and to augment municipal supplies for Rapid City, S. Dak.

Contract was executed for the construction of Dodson pumping unit of the Milk River project. Repayment contract has been executed with the Dodson irrigation district, and the project will be completed in time for water delivery in 1947.

Contract was executed for the construction of the Big Flat unit, Missoula Valley project in the Columbia Basin unit, and will be completed for water delivery in 1947.

Contract has been executed for the construction of the Fallon unit of division No. 2 of the Buffalo Rapids project.

Surveys for the completion of the Riverton project in Wyoming have been in active progress. Two construction contracts have been executed and work under them is in active progress.

Surveys for the completion of the Heart Mountain division of the Shoshone project have also been under way. Two construction contracts have been executed. Preparations have been made for the opening to entry of 83 farm units of public land in fiscal year 1947. Plans and specifications for the construction of the Heart Mountain power plant on the Shoshone project have been completed.

On the Sun River project, the Pishkun siphon was completed.

On the Fort Peck project the 115-kilovolt transmission line from Fort Peck to Glendive was completed, and was energized on December 1, 1945.

Plans and specifications were completed for the 115-kilovolt transmission lines from Glendive to Miles City, Mont., and from Fort Peck, through Williston, N. Dak., to Garrison Dam in North Dakota. The portion from Williston to Garrison is considered a part of the Missouri Basin project.

On the projects constructed by this Bureau in region 6, farm operations in 1945 were generally successful and crop yields were good. Crops valued at $14,079,000 were produced on 360,000 acres. In addition, large numbers of livestock were produced and marketed. Production included 428,000 tons of sugar beets, or 6.5 percent of the Nation's total. Other major crop items included 502,000 bushels of beans; 550,000 bushels of potatoes, and 3,375,000 bushels of grains. A large part of the grain was fed to livestock locally.

The Fort Peck power plant is operated by the Corps of Engineers. The power generated is marketed by the Bureau of Reclamation. During fiscal year 1946 contracts for the sale of power to the following organizations were executed: Valley County Electric Cooperative near Whatley, Mont., 450 kilowatts; Mid-Yellowstone Electric Cooperative near Forsythe, Mont., 335 kilowatts; Montana-Dakota Utilities Co. for delivery of approximately 55 kilowatts, near Frazer and Oswego, Mont. A memorandum of understanding was executed with the Office of Indian Affairs for the use of certain transmission facilities under its jurisdiction and for delivery to the Indian Office of power required for irrigation pumping and other uses.

During the fiscal year, the Fort Peck, Shoshone and Riverton projects generated 172,241,000 kilowatt-hours of which 100,900,000 kilowatt-hours were generated on the Fort Peck project.

Housing shortages.—Housing shortages have been very severe throughout the region. Some Quonset huts and trailer houses have been obtained and put to use. Some construction buildings at a chrome mine have been obtained and dismantled and the material salvaged for use elsewhere. Four small housing units at the same mine have been obtained and plans have been made for dismantling them, moving them to regional headquarters, and reerecting them.

There has also been a serious shortage of many items of supplies and construction materials. In particular, construction work has been greatly retarded by lack of lumber and reinforcing steel.

Region 7

In region 7, comprising almost one-half of Wyoming, almost all of Nebraska, the north half of Kansas and that portion of Colorado east of the Continental Divide, 2 projects were in operation, 3 under construction, 7 under authorization and 25 in study status during the fiscal year ended June 30, 1946.

Following VJ-day, construction was greatly accelerated on the Colorado-Big Thompson project and during the year the 13.1-mile Alva B. Adams

Tunnel, under the Continental Divide, and Shadow Mountain Dam on the western slope of Colorado, were both completed. Work continued on the dikes for Granby Reservoir. In June, contracts totaling approximately $16,000,000 were awarded for the construction of Granby Dam and Horsetooth Reservoir—both important links in the Colorado-Big Thompson project.

The concrete lining of the Adams Tunnel was completed in February. Construction work on Rams Horn and Prospect Mountain Tunnels is ahead of schedule and bids have been announced for penstocks and for construction of the Estes Park and Marys Lake power plants.

Highlight of the construction year was the ground-breaking ceremony held May 15 at Kortes Dam site, when the Morrison-Knudsen Co., Boise, Idaho, began work on their $4,688,000 contract. Kortes Dam was the first unit of the entire Missouri Basin plan to reach construction stage.

The seven projects authorized but not yet under construction are all units of the Missouri Basin program and include: Frenchman-Cambridge unit, Nebraska, Bostwick unit, Nebraska-Kansas, Cedar Bluffs unit, Kansas, Kirwin unit, Kansas, Glendo unit, Wyoming, North Republican unit, Colorado-Kansas and the Wells unit, Kansas-Nebraska.

On the Frenchman-Cambridge unit the preconstruction work necessary for the preparation of final plans and specifications was completed on Enders Dam, Medicine Creek Dam, Cambridge Diversion Dam and the Cambridge-Oxford Canal.

On the Cedar Bluffs unit, foundation investigations were started on the Cedar Bluffs Dam.

On the Kirwin unit, preconstruction work necessary for the preparation for final plans and specifications for Kirwin Dam was completed.

Preconstruction work was begun on the Glendo Dam, Glendo unit, during the year as well.

River basin surveys.—During the year additional plans were developed for the Missouri River Basin as well as for the three major transmountain diversion projects.

All of the approved projects listed in Senate Document No. 191 have been subjected to further study and analysis to develop the most meritorious plan before requesting authorization.

Investigation of the Niobrara River Basin in northern Nebraska was initiated during the year. This basin survey will develop a plan for maximum use of the surplus waters in the basin which will be in excess of 500,000 acre-feet annually. The annual precipitation varies from 16 to 22 inches annually and there is an urgent need for power development in this area.

Basic data for the preparation of a report have been compiled for the Blue River-South Platte and Gunnison-Arkansas projects in Colorado. Project development and construction costs on these two projects alone will approach $800,000,000. The proposed projects will irrigate over 1,000,000 acres of land and will produce over 4,500,000,000 kilowatt-hours of electrical energy annually—sufficient practically to revolutionize existing Mountain States industries and create many new ones.

Transmountain diversion projects in Wyoming also are under investigation. New sources of water for the irrigable areas in the Saratoga-Encampment area and in the valley of the Sweetwater and Laramie Rivers. are being sought. Authorization of these projects will not be sought until the Upper Basin States have agreed on allocation of Colorado River water.

Ground water investigations.—Investigations of ground water resources have gained impetus during the last year. A closely knit cooperative program has been developed with the United States Coast and Geodetic Survey covering ground water possibilities in all potential pumping areas, and including stream gaging, chemical analysis and sediment studies throughout the region. Ground water supplies are recognized as an important factor in the future prosperity of our irrigated areas. Subterranean storage, timed recharging for pump requirements to augment or supplement surface supplies and continuing records of water tables for future operations are important elements in this program.

During the year the Kendrick project reached the operations stage. The first irrigation water flowed through the Casper Canal to unit No. 1 (a distance of 62 miles), on June 20. It is expected that 3,500 acres of new land will be brought under irrigation during the present year and ultimately 35,000 acres will be irrigated. The principal crops to receive water this year will be alfalfa and small grain.

Water rental notices were issued on the Mirage Flats project, northeast Nebraska, and it is expected that about 5,000 acres will receive water during the 1946 irrigation season.

This year also witnessed the growth of region 7's power load. During the war the interconnected power system of Colorado-Nebraska and Wyoming served a number of war emergency loads but after VJ-day these, of course, fell off. By February 1946, power requirements of the system had exceeded those of the previous year, thereby wiping out all war-load losses.

REA cooperatives continued to receive electric energy from the Bureau particularly for irrigation pumping. In southeast Wyoming and northeast Colorado, crop production was greatly increased during the usual critical times.

Funds were approved by Congress during the year for the extension of the Bureau's transmission system into eastern Colorado where electrical energy will be made available for additional irrigation pumping and for an expansion of the productive area in that part of the State.

In the fiscal year just completed the four hydro-power plants of region 7 generated 235,700,000 kilowatt-hours of electricity, which is a 27 percent increase over the previous year. Some 30,000,000 kilowatt-hours were purchased by region 7. There were 236,800,000 kilowatt-hours of energy sold to municipalities, REA cooperatives, industrial plants, army camps and public utilities for a gross revenue of $1,582,000—also an increase of 27 percent over the previous year.

Organization

Although reorganization of the Bureau was set in motion in September 1943 to prepare for the vastly expanded activities foreseen with the war's end, many of the administrative improvements contemplated in the reorganization plans were necessarily suspended because of lack of staff and because many of the planned improvements were geared to and dependent upon the anticipated expansion of the Bureau's program. With Congress' complete endorsement in August 1945 of the reorganization plan, the cessation of hostilities was the signal for application of the long-held plans.

The plans placed into effect provided for the administrative consolidation of all field activities into seven regions. Operating policies and practices required complete reshaping so as to provide for the assumption of major administrative responsibilities by the seven regional offices. The Office of Management Planning was the administrative facility used to provide the necessary technical guidance and assistance in all phases of the wholesale reorganization.

Comprehensive Manual of Instructions

The termination of the war also enabled the Office of Management Planning to recruit promptly a small staff to guide and assist the branches and offices of the Bureau in the preparation of a long-needed comprehensive manual of rules, regulations, and operating procedures. Such a manual was foreseen as especially necessary to facilitate the indoctrination and training of a greatly expanded Bureau staff. Several of the handbooks of the manual system were completed during the fiscal year, and the schedule calls for completion of the balance of the handbooks early in fiscal year 1947. The manual is designed to set forth the legislative enactments governing the Bureau's program, Department and Bureau policies, and administrative procedures for the effective and efficient performance of the Bureau's responsibilities. In addition, the handbooks of the manual will set forth the standards and requirements of the Bureau's highly technical undertakings in the fields of engineering, economics, water utilization and electric power generation and transmission.

Administrative Examinations

During the fiscal year the administrative examiners of the Office of Management Planning completed administrative surveys of five of the Bureau's seven regional offices. The administrative examinations completed have been very fruitful in bringing to the fore the administrative problems and requirements of the regions surveyed, thus facilitating the administrative action required to resolve existing problems and make provision for administrative requirements developing along with expanded program activities.

Decentralization and Consolidations

Search for improved administrative efficiency and effectiveness lead to studies of needs for decentralization of authority and responsibility and for consolidation of duplicated phases in related field activities. These studies resulted in consolidation of project and other field activities in homogenous geographical areas where such consolidations result in more economical and effective performance of Bureau work and enable further decentralization of authority and responsibility. The facility for effecting such consolidations and providing for further delegations of authority and responsibility is termed a district organization. District organizations were established during the fiscal year in regions 1, 2, 3, and 7.

Establishment of Uniform Regional Staffs

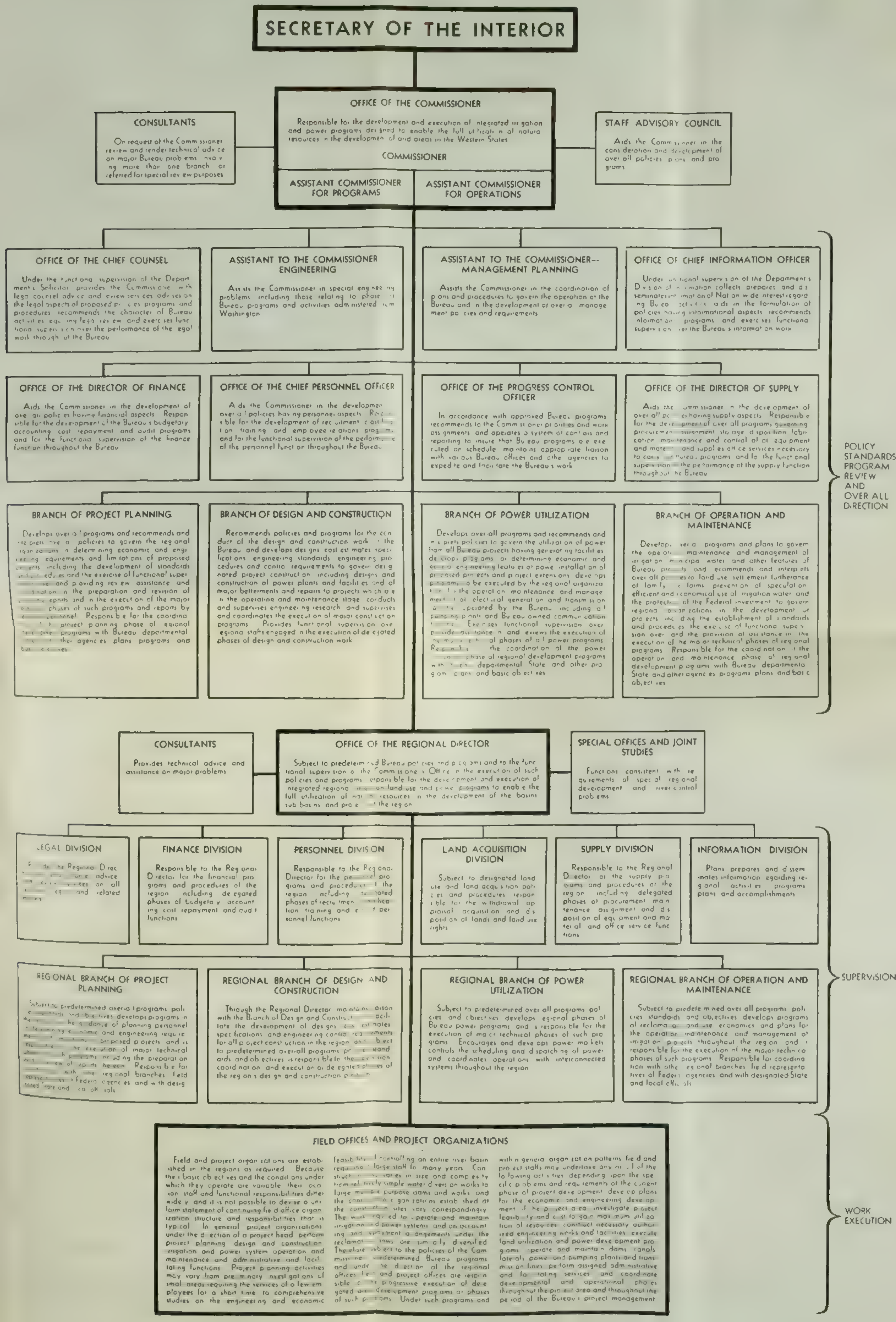
Establishment of uniform staffs for the regional offices in order to facilitate the performance of regional office responsibilities and the exercise of necessary controls by the Commissioner came about during the fiscal year. A major part of this establishment was the preparation of standard job descriptions for the authorized positions.

Program and Progress Charting

To direct the scheduling of work programs, operate controls, and institute reporting procedures for measurement and evaluation of progress, an Office of Progress Control has been established this year. The new office provides current reports on work progress and on any conditions delaying scheduled performance. By directing the attention of the staff offices to the reported needs of the field offices, the office aids in coordinating and facilitating the work of the Bureau. In administering procedures for scheduling and reporting, the Chief Progress Control Officer exercises functional direction over all the progress control units in the regional offices.

Shortly after the office was established and before it was fully staffed, it was faced with the problem of obtaining work schedules for the second half of the fiscal year for the enlarged program of work made possible by the funds appropriated by the First Deficiency Act of 1946. In accordance with procedures outlined by the Office of Progress Control, the proj-

MASTER ORGANIZATION CHART, UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION



SECRETARY OF THE INTERIOR

CONSULTANTS

On request of the Commissioner review and render technical advice on major Bureau problems involving more than one branch or referred for special review purposes

OFFICE OF THE COMMISSIONER

Responsible for the development and execution of integrated irrigation and power programs designed to enable the full utilization of natural resources in the development of arid areas in the Western States

COMMISSIONER

ASSISTANT COMMISSIONER FOR PROGRAMS

ASSISTANT COMMISSIONER FOR OPERATIONS

STAFF ADVISORY COUNCIL

Aids the Commissioner in the consideration and development of over-all policies plans and programs

OFFICE OF THE CHIEF COUNSEL

Under the functional supervision of the Department's Solicitor provides the Commissioner with legal counsel advice and review services advises on the legal aspects of proposed policies programs and procedures recommends the character of Bureau activities requiring legal review and exercises functional supervision over the performance of the legal work throughout the Bureau

ASSISTANT TO THE COMMISSIONER ENGINEERING

Assists the Commissioner in special engineering problems including those relating to phases of Bureau programs and activities administered from Washington

ASSISTANT TO THE COMMISSIONER—MANAGEMENT PLANNING

Assists the Commissioner in the coordination of plans and procedures to govern the operation of the Bureau and in the development of over-all management policies and requirements

OFFICE OF CHIEF INFORMATION OFFICER

Under functional supervision of the Department's Division of Information collects prepares and disseminates information of Nation-wide interest regarding Bureau activities aids in the formulation of policies having informational aspects recommends informational programs and exercises functional supervision over the Bureau's information work

OFFICE OF THE DIRECTOR OF FINANCE

Aids the Commissioner in the development of over-all policies having financial aspects Responsible for the development of the Bureau's budgetary accounting cost repayment and audit programs and for the functional supervision of the finance function throughout the Bureau

OFFICE OF THE CHIEF PERSONNEL OFFICER

Aids the Commissioner in the development of over-all policies having personnel aspects Responsible for the development of recruitment classification training and employee relations programs and for the functional supervision of the performance of the personnel function throughout the Bureau

OFFICE OF THE PROGRESS CONTROL OFFICER

In accordance with approved Bureau programs recommends to the Commissioner priorities and work assignments and operates a system of controls and reporting to insure that Bureau programs are executed on schedule maintains appropriate liaison with various Bureau offices and other agencies to expedite and facilitate the Bureau's work

OFFICE OF THE DIRECTOR OF SUPPLY

Aids the Commissioner in the development of over-all policies having supply aspects Responsible for the development of over-all programs governing procurement assignment storage disposition fabrication maintenance and control of all equipment and materials and supplies office services necessary to carry out Bureau programs and for the functional supervision of the performance of the supply function throughout the Bureau

BRANCH OF PROJECT PLANNING

Develops over-all programs and recommends and interprets over-all policies to govern the regional organizations in determining economic and engineering requirements and limitations of proposed projects including the development of standards and procedures and the exercise of functional supervision [illegible] and providing review assistance and coordination in the preparation and revision of [illegible] reports and in the execution of the major [illegible] phases of such programs and reports by [illegible] personnel Responsible for the coordination [illegible] project planning phase of regional development programs with Bureau departmental [illegible] other agencies plans programs and basic objectives

BRANCH OF DESIGN AND CONSTRUCTION

Recommends policies and programs for the conduct of the design and construction work of the Bureau and develops designs cost estimates specifications engineering standards engineering procedures and control requirements to govern designated project construction including designs and construction of power plants and facilities and of major betterments and repairs to projects which are in the operating and maintenance stage conducts and supervises engineering research and supervises and coordinates the execution of major construction programs Provides functional supervision over regional staffs engaged in the execution of delegated phases of design and construction work

BRANCH OF POWER UTILIZATION

Develops over-all programs and recommends and interprets policies to govern the utilization of power from all Bureau projects having generating facilities develops programs for determining economic and general engineering features of power installation of proposed projects and project extensions develops programs to be executed by the regional organizations for the operation maintenance and management of all electrical generation and transmission [illegible] operated by the Bureau including all pumping plants and Bureau owned communication [illegible] Exercises functional supervision over [illegible] provides assistance in and reviews the execution of the major technical phases of all power programs Responsible for the coordination of the power [illegible] phase of regional development programs with [illegible] departmental State and other programs plans and basic objectives

BRANCH OF OPERATION AND MAINTENANCE

Develops over-all programs and plans to govern the operation maintenance and management of irrigation municipal water and other features of Bureau projects and recommends and interprets over-all policies to land use settlement furtherance of family-size farms prevention of speculation efficient and economical use of irrigation water and the protection of the Federal investment to govern regional organizations in the development of projects including the establishment of standards and procedures the exercise of functional supervision over and the provision of assistance in the execution of the major technical phases of regional programs Responsible for the coordination of the operation and maintenance phase of regional development programs with Bureau departmental State and other agencies programs plans and basic objectives

CONSULTANTS

Provides technical advice and assistance on major problems

OFFICE OF THE REGIONAL DIRECTOR

Subject to predetermined Bureau policies and programs and to the functional supervision of the Commissioner's Office in the execution of such policies and programs responsible for the development and execution of integrated regional irrigation land use and power programs to enable the full utilization of natural resources in the development of the basins sub-basins and projects [illegible] the region

SPECIAL OFFICES AND JOINT STUDIES

Functions consistent with requirements of special regional development and river control problems

LEGAL DIVISION

[illegible] the Regional Director [illegible] advice [illegible] on all [illegible] and related [illegible]

FINANCE DIVISION

Responsible to the Regional Director for the financial programs and procedures of the region including delegated phases of budgetary accounting cost repayment and audit functions

PERSONNEL DIVISION

Responsible to the Regional Director for the personnel programs and procedures of the region including delegated phases of recruitment classification training and [illegible] personnel functions

LAND ACQUISITION DIVISION

Subject to designated land use and land acquisition policies and procedures responsible for the withdrawal appraisal acquisition and disposition of lands and land use rights

SUPPLY DIVISION

Responsible to the Regional Director of the supply programs and procedures of the region including delegated phases of procurement maintenance assignment and disposition of equipment and material and office service functions

INFORMATION DIVISION

Plans prepares and disseminates information regarding regional activities programs plans and accomplishments

REGIONAL BRANCH OF PROJECT PLANNING

Subject to predetermined over-all programs policies [illegible] and objectives develops programs in [illegible] the guidance of planning personnel [illegible] economic and engineering requirements [illegible] proposed projects and is [illegible] the execution of major technical [illegible] programs including the preparation [illegible] of reports thereon Responsible for [illegible] with other regional branches field [illegible] Federal agencies and with designated State and local officials

REGIONAL BRANCH OF DESIGN AND CONSTRUCTION

Through the Regional Director maintains liaison with the Branch of Design and Construction [illegible] facilitate the development of designs cost estimates specifications and engineering control requirements for all project construction in the region and subject to predetermined over-all programs [illegible] standards and objectives is responsible for the [illegible] coordination and execution of delegated phases of the region's design and construction program

REGIONAL BRANCH OF POWER UTILIZATION

Subject to predetermined over-all programs policies and objectives develops regional phases of Bureau power programs and is responsible for the execution of major technical phases of such programs Encourages and develops power markets controls the scheduling and dispatching of power and coordinates operations with interconnected systems throughout the region

REGIONAL BRANCH OF OPERATION AND MAINTENANCE

Subject to predetermined over-all programs policies standards and objectives develops programs of reclamation [illegible] and use economics and plans for the operation maintenance and management of irrigation projects throughout the region and is responsible for the execution of the major technical phases of such programs Responsible for coordination with other regional branches field representatives of Federal agencies and with designated State and local officials

FIELD OFFICES AND PROJECT ORGANIZATIONS

Field and project organizations are established in the regions as required Because the basic objectives and the conditions under which they operate are variable their location staff and functional responsibilities differ widely and it is not possible to devise a uniform statement of continuing field office organization structure and responsibilities that is typical In general project organizations under the direction of a project head perform project planning design and construction irrigation and power system operation and maintenance and administrative and facilitating functions Project planning activities may vary from preliminary investigations of small areas requiring the services of a few employees for a short time to comprehensive studies on the engineering and economic feasibility [illegible] controlling an entire river basin requiring a large staff for many years Construction [illegible] varies in size and complexity from relatively simple water diversion works to large multiple purpose dams and works and the construction organizations established at the construction sites vary correspondingly The works required to operate and maintain irrigation and power systems and the accounting and repayment arrangements under the reclamation laws are similarly diversified These are subject to the policies of the Commissioner [illegible] predetermined Bureau programs and under the direction of the regional offices field and project offices are responsible for the progressive execution of delegated development programs or phases of such programs Under such programs and with a general organization pattern field and project staffs may undertake any or all of the following activities depending upon the specific problems and requirements of the current phase of project development develop plans for the economic and engineering development of the project area investigate project feasibility and cost to gain maximum utilization of resources construct necessary authorized engineering works and facilities execute land utilization and power development programs operate and maintain dams canals laterals power and pumping plants and transmission lines perform assigned administrative and facilitating services and coordinate developmental and operational phases throughout the project area and throughout the period of the Bureau's project management

ect work programs were proposed by the regional directors, reviewed and coordinated by the staff officers, approved by the Commissioner, and issued as the Commissioner's Program, January–June 1946. This advance planning has been invaluable in promoting expeditious and efficient accomplishment of all phases of the Bureau's work connected with the construction program. To assure timely achievement of long-range objectives, all basic project programs are being revised, taking into consideration the results of the January–June work program just completed and the funds appropriated for fiscal year 1947. When the revised basic programs are approved, the detailed work schedules for each operating office during 1947 will be developed.

The operation of progress control is a new function for the Bureau. As emphasis was placed first upon work, scheduling progress reporting procedures have had to be geared directly to the work schedules as they were established. A reporting procedure has been instituted to indicate periodically the status of performance on the construction program as well as the outlook for future accomplishment. The outlook report enables the various offices to adjust their operations to the coming work load. A status report of progress on the Bureau programs has been developed and four issues have been prepared measuring accomplishment in comparison with the amount of work scheduled. This report currently covers the programs of construction, project planning, and personnel recruitment and indicates the status of funds, invitations issued, awards of contracts, and the procurement of supplies. Detailed narrative reports of regional office activities are summarized and matters requiring attention are referred to the offices concerned.

Field Procedures Survey

Study was made during the year of the field reporting procedures and a survey was conducted to determine upon a system that would contribute the maximum information with the least burden upon the operating field offices. The reporting procedures will be coordinated with the developments in work scheduling and programming, and expanded to measure periodic progress on the basis of physical completion, cost, and time. Accurate and comprehensive progress reporting and analysis becomes increasingly important as the work of the Bureau increases in volume and in scope.

Financial Operation and Control

At the end of the 1946 fiscal year the total investment of the Federal Government in projects constructed by the Bureau of Reclamation amounted to $993,056,468, an increase of $40,162,926 over the previous year.

TABLE 5.—*Consolidated statement by projects of construction cost of irrigation and power works, other items reimbursable with construction, and deductions*

State and project	Construction cost		Operation and maintenance before public notice (net)		Operation and maintenance deficits, arrearages, and penalties		Construction revenues, contributed funds, and nonreimbursable appropriations (contra)		Abandoned works, nonreimbursable cost and authorized charge-offs	Net balance	
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946		Fiscal year 1946	To June 30, 1946
Arizona:											
Gila	$856,755.76	$8,564,919.63	[1]$15,092.74	[1]$32,411.24			[1]$218,351.70	[1]$311,287.30		$1,060,014.72	$8,843,795.69
Salt River		20,244,688.48		115,993.50		$866,573.92		3,200,814.81	$382,097.31		17,644,343.78
Yuma Auxiliary		902,060.50				590.36	112.13	2,251.00		[1]112.13	900,399.86
Arizona-California: Yuma		9,373,406.10		388,934.62	[1]$0.04	210,434.05	2,871.89	301,498.06		[1]2,871.93	9,671,276.71
California:											
Central Valley	4,204,949.71	163,186,067.00	[1]29,082.69	40,368.78			13,638.16	365,213.13		4,162,228.86	162,861,222.65
Orland		2,448,669.71		[1]11,432.99	233.38	62,634.63		28,414.77		233.38	2,471,456.58
Colorado:											
Colorado-Big Thompson	4,897,387.37	26,387,750.83					954,603.65	1,112,102.01		3,942,783.72	25,275,648.82
Fruitgrowers Reservoir		200,740.71						2,500.00			198,240.71
Grand Valley	60.32	5,095,621.98		138,621.28		4,529.40	6,224.35	275,937.18	812,374.64	[1]6,164.03	4,150,460.84
Paonia	178.15	56,681.30								178.15	56,681.30
Pine River	[1]296.04	3,329,532.28		1,695.72		2,519.44	90.00	2,319.77		[1]386.04	3,331,427.67
San Luis Valley	79,465.81	310,315.45								79,465.81	310,315.45
Uncompahgre		8,976,443.18		311,103.02	[1]135.11	196,368.80	20.00	25,601.42	[2]1,261,956.28	[1,2]1,319.46	8,196,357.30
Idaho:											
Boise		16,035,747.35		422,283.48		903,699.42	54,080.93	1,348,651.53	82,393.84	[1]54,080.93	15,930,684.88
Boise-Anderson Ranch	5,479,431.06	15,611,216.10					4,636.19	13,998.37		5,474,794.87	15,597,217.73
Boise-Payette	99,700.61	4,930,502.20	[1]10,477.19	11,589.77			734.55	3,614.53		88,488.87	4,938,477.44
King Hill		1,905,918.80				110,122.51		28,187.27	1,987,854.04		
Minidoka	1,905.36	22,717,999.24	[1]379.58	315,719.59		644,440.26	42,957.05	2,207,869.91	2,288.15	[1]41,431.27	21,468,001.03
Palisades	186,798.56	217,053.84								186,798.56	217,053.84
Kansas: Garden City		342,963.68		52,868.10				61,356.82	334,474.96		
Montana:											
Bitter Root		947,641.05				516,637.95					1,464,279.00
Frenchtown		273,603.11		5,496.26							279,099.37
Hungry Horse	161,571.66	161,571.66								161,571.66	161,571.66
Huntley		1,559,590.46		[1]1,000.16		391,067.46	8,604.57	35,441.58	62,049.83	[1]8,604.57	1,852,166.35
Milk River	35.76	8,673,406.88	[1]71.57	436,505.82		101,062.03	463.50	124,261.96	1,735,969.31	[1]499.31	7,350,743.46
Sun River	104,781.46	9,751,509.35		133,102.38		103,137.65		48,555.64	89,650.57	104,781.46	9,849,543.17
Montana-North Dakota: Lower Yellowstone		3,685,433.14	[1]1,697.42	[1]1,697.42		922,893.29	998.44	130,719.25	382,254.00	[1]2,695.86	4,093,655.76
Nebraska-Wyoming: North Platte		19,551,148.27		743,294.42		1,516,486.08	1,554.01	851,393.84		[1]1,554.01	20,959,534.93

Nevada:											
Humboldt		1,293,741.14		21,020.51			119,466.07	123,772.73		[1] 119,466.07	1,190,988.92
Newlands		7,947,282.86		[1] 2,155.44		44,976.32		52,347.53	4,437,820.00		3,499,936.21
Truckee Storage		1,093,328.31		9,926.48			50.00	22,048.30		[1] 50.00	1,081,206.49
New Mexico:											
Carlsbad	5,180.00	3,990,096.44		[1] 17,751.77		93,395.50		30,094.22	374,883.58	5,180.00	3,660,762.37
Hondo		339,491.68		32,952.01				656.03	371,787.66		
Tucumcari	2,010,500.28	9,304,470.35	14,405.25	14,405.25						2,024,905.53	9,318,875.60
New Mexico-Texas: Rio Grande	338,936.35	20,833,336.61		15,771.13		364,531.65	1,557,220.75	4,734,148.12	357,841.20	[1] 1,218,284.40	16,121,650.07
North Dakota:											
Buford-Trenton		223,423.06		[1] 31.75				1,967.62	221,423.69		
Williston		517,630.09		[1] 165.00				108,370.40	409,094.69		
Oklahoma: Altus	1,085,236.24	6,627,221.69					6,750.00	1,136,750.00		1,078,486.24	5,490,471.69
Oregon:											
Baker		281,591.64						5,003.00			276,588.64
Burnt River		601,025.82						1,290.82			599,735.00
Deschutes	1,642,365.22	5,472,932.76		2,294.13						1,642,365.22	5,475,226.89
Umatilla		5,237,828.06			[1] 419.63	230,117.15	2,025.41	107,020.07	888,340.82	[1] 2,445.04	4,472,584.32
Vale	3,057.87	4,858,971.22		39,773.56		3,027.24	1,037.20	23,442.69		2,020.67	4,878,329.33
Oregon-California: Klamath	414,427.63	7,880,612.04	[1] 278.13	100,726.12		85,433.09	555,820.17	2,125,782.17	7,499.72	[1] 141,670.67	5,933,489.36
Oregon-Idaho: Owyhee	49,820.55	18,188,279.91			[1] 52,688.07	259,076.52	1,828.77	20,612.48		[1] 4,696.29	18,426,743.95
South Dakota: Belle Fourche		4,630,391.88		[1] 1,989.03		676,577.53		29,042.05	379,031.58		4,896,906.75
Texas: Valley Gravity Canal and Storage	244,974.35	521,867.41								244,974.35	521,867.41
Utah:											
Hyrum		941,884.54						11,884.54			930,000.00
Moon Lake		1,600,360.94						8,093.18			1,592,267.76
Ogden River	1,206.99	4,379,795.73		2,361.87				12,886.97		1,206.99	4,369,270.63
Provo River	1,366,719.74	11,185,640.81	[1] 25,888.68	[1] 16,069.33			1,645.50	32,543.17		1,339,185.56	11,137,028.31
Salt Lake Basin		2,725,885.40				5,897.20	40.00	46,385.77		[1] 40.00	2,685,396.83
Sanpete		374,540.34						1,284.40			373,255.94
Strawberry Valley		3,507,423.49		10,744.06		89,635.49		258,379.12			3,349,423.92
Washington:											
Okanogan		1,452,129.45		[1] 47,766.87		26,882.64		7,496.28	997,861.70		425,887.24
Yakima		26,346,976.81	86,328.75	21,971.67		150,166.74	54,126.97	785,842.42	4,214.60	32,201.78	25,729,058.20
Yakima-Roza	422,591.82	11,792,008.43	[1] 21,971.49	44,249.21			178.30	1,735.40		400,442.03	11,834,522.24
Wyoming:											
Kendrick	11,401.59	18,138,762.57	24,040.02	124,247.27			1,733,084.78	1,744,627.63		[1] 1,697,643.17	16,518,382.21
Riverton	131,907.70	6,445,971.23			[1] 18,184.40	101,965.04	1,183.95	31,927.51		112,539.35	6,516,008.76
Shoshone	3,021.71	10,497,541.23	[1] 2,105.44	27,550.01		467,235.44	148,468.30	1,485,615.86	1,545,129.47	[1] 147,552.03	7,961,581.35
Shoshone-Heart Mountain	68,046.19	4,429,800.75	10,248.21	30,243.81						78,294.40	4,460,044.56
Total	23 872,119.78	559,104,446.97	27,977.30	3,483,342.83	[1]71,193.87	9,152,114.80	5,056,163.89	22,810,466.03	17,128,291.64	18,771,574.97	531,801,146.93

See footnotes at end of table, p. 115.

TABLE 5.—*Consolidated statement bv projects of construction cost of irrigation and power works, other items reimbursable with construction, and deductions*—Con.

WATER CONSERVATION AND UTILITY PROJECTS

State and project	Construction cost		Operation and maintenance during construction		Construction revenues [1]		Net construction cost	
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946
Colorado: Mancos	$169, 272. 91	$748, 325. 50					$169, 272. 91	$748, 325. 50
Idaho:								
Mann Creek		32, 836. 75				$267. 47		32, 569. 28
Rathdrum Prairie	227, 111. 12	349, 313, 78	$892. 31	$892. 31	[1] $2. 00	5. 00	228, 005. 43	350, 201. 09
Montana:								
Bitterroot	22, 558. 02	86, 580. 83					22, 558. 02	86, 580. 83
Buffalo Rapids, first division	5. 239. 83	2, 004, 361. 40		39, 695. 81		665. 07	5, 239. 83	2, 043, 392. 14
Buffalo Rapids, second division	109, 573. 30	1, 440, 094. 05	16, 587. 26	31, 928. 94			126, 160. 56	1, 472, 022. 99
Intake	62, 497. 81	68, 166. 78	1, 250. 34	1, 250. 34			63, 748. 15	69, 417. 12
Milk River, Dodson	41, 687. 79	45, 764. 99					41, 687. 79	45, 764. 99
Missoula Valley	92, 764. 58	114, 797. 85					92, 764. 58	114, 797. 85
Saco Divide	[1] 22. 00	2, 477. 97					[1] 22. 00	2, 477. 97
Nebraska: Mirage Flats	1, 010, 677. 85	2, 569, 251. 60	[1] 3, 000. 00	3, 000. 00	[1] 1, 100. 00	495. 00	1, 008, 777. 85	2, 565, 756. 60
North Dakota: Buford-Trenton		945, 858. 84						945, 858. 84
South Dakota:								
Angostura		43, 484. 62						43, 484. 62
Rapid Valley	135, 589. 48	761, 693. 85			186. 16	1, 702. 44	135, 403. 32	759, 991. 41
Texas: Balmorhea	13, 123. 66	29, 821. 05					13, 123. 66	29, 821. 05
Utah:								
Newton	65, 427. 24	534, 207. 28					65, 427. 24	534, 207. 28
Scofield	464, 017. 02	806, 171. 56					464, 017. 02	806, 171. 56
Wyoming: Eden	40, 414. 49	392, 104. 41					40, 414. 49	392, 104. 41
Total	2, 459, 933. 10	10, 975, 313. 11	15, 729. 91	70, 767. 40	[1] 915. 84	3, 134. 98	2, 476, 578. 85	11, 042, 945. 53

SPECIAL PROJECTS

State and project	Construction cost		Contributions		Net balance	
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946
Colorado River Dam fund:						
All-American Canal	$3, 960, 840. 29	$36, 193, 804. 53	$20, 000. 00	$20, 000. 00	$3, 940, 840. 29	$36, 173, 804. 53
Boulder Canyon	1, 771, 192. 39	144, 158, 697. 68	70, 149. 97	70, 149. 97	1, 701, 042. 42	144, 088, 547. 71
Arizona:						
Davis Dam	2, 407, 265. 04	5, 907, 120. 81			2, 407, 265. 04	5, 907, 120. 81
Parker Dam		6, 821, 853. 10		6, 821, 853. 10		
Parker Power	332, 457. 99	15, 520, 645. 34			332, 457. 99	15, 520, 645. 34
Montana: Fort Peck	165, 857. 71	810, 607. 63			165, 857. 71	810, 607. 63
Texas: Colorado River	124, 242. 93	23, 869, 183. 17	9, 580. 75	9, 580. 75	114, 662. 18	23, 859, 602. 42
Washington: Columbia Basin	5, 069, 016. 83	189, 694, 795. 86	5, 181, 658. 23	5, 181, 658. 23	[1] 112, 641. 40	184, 513, 137. 63
Total	13, 830, 873. 18	422, 976, 708. 12	5, 281, 388. 95	12, 103, 242. 05	8, 549, 484. 23	410, 873, 466. 07
Grand total	40, 162, 926. 06	993, 056, 468. 20				

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[1] Contra.

[2] Includes $1,164.35 authorized charge-offs applicable to fiscal year 1946.

Operations of Reclamation Fund

During its 44 years of operation accretions to the Reclamation fun have totaled $233,480,443. These have come from the sale of public lands proceeds from the Oil Leasing Act, from Federal water power licenses potassium royalties and rentals, and receipts from naval petroleum reserve from 1920 to 1930 under the act of May 9, 1938.

TABLE 6.—*Accretions to Reclamation fund by States*

State	Sale of public lands		Proceeds from Oil Leasing Act		Total to Jun 30, 1946
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	
Alabama			$659. 24	$198, 295. 02	$198, 295. 0
Arizona	$11, 243. 39	$2, 777, 582. 75	2, 833. 69	12, 128. 16	2, 789, 710. 91
Arkansas				886. 47	886. 47
California	30, 133. 18	8, 334, 200. 72	1, 539, 779. 07	26, 526, 608. 23	34, 860, 808. 95
Colorado	8, 168. 63	10, 334, 498. 83	320, 693. 64	1, 764, 465. 29	12, 098, 964. 12
Florida			10. 50	10. 50	10. 50
Idaho	5, 891. 43	7, 063, 989. 01	328. 31	23, 230. 15	7, 087, 219. 16
Kansas	965. 72	1, 034, 567. 12	5, 873. 55	56, 541. 49	1, 091, 108. 61
Louisiana			7, 424. 35	363, 056. 43	363, 056. 43
Michigan			1, 902. 11	4, 292. 46	4, 292. 46
Mississippi			113. 66	345. 97	345. 97
Montana	9, 288. 97	15, 397, 913. 87	269, 221. 14	2, 631, 783. 38	18, 029, 697. 25
Nebraska	2, 109. 14	2, 099, 807. 84		446. 25	2, 100, 254. 09
Nevada	2, 177. 46	1, 044, 523. 36	5, 132. 26	29, 493. 27	1, 074, 016. 63
New Mexico	17, 652. 46	6, 760, 462. 76	758, 317. 83	6, 668, 312. 70	13, 428, 775. 46
North Dakota	470. 86	12, 220, 117. 13	16, 119. 86	319, 616. 31	12, 539, 733. 44
Oklahoma	882. 32	5, 932, 027. 90	3, 117. 14	16, 298. 30	5, 948, 326. 20
Oregon	2, 834. 24	11, 998, 158. 97	1, 420. 53	3, 370. 57	12, 001, 529. 54
South Dakota	925. 55	7, 734, 601. 03	3, 142. 28	33, 245. 55	7, 767, 846. 58
Utah	3, 375. 44	4, 400, 914. 92	145, 680. 92	1, 637, 359. 64	6, 038, 274. 56
Washington	5, 904. 61	7, 481, 006. 83	1, 840. 87	47, 956. 95	7, 528, 963. 78
Wyoming	15, 836. 67	8, 737, 917. 22	1, 714, 713. 59	46, 455, 757. 32	55, 193, 674. 54
Total	117, 860. 07	113, 352, 290. 26	4, 798, 324. 54	86, 793, 500. 41	200, 145, 790. 67
Proceeds, Federal water power licenses					[1] 1, 031, 757. 60
Proceeds, potassium royalties and rentals					[2] 2, 522, 872. 24
Receipts from naval petroleum reserves, 1920–38, act of May 9, 1938					29, 778, 300. 23
Proceeds from right-of-way over withdrawn lands, act of July 19, 1919					1, 722. 64
Grand total					233, 480, 443. 38

[1] Proceeds for fiscal year, $34,944.75.

[2] Proceeds for fiscal year, $420,677.90.

Collections.—Construction and operation, and maintenance repayments, water rentals, power revenues, etc., have totaled $195,484,979.

Disbursements during that period have totaled $381,070,315, leaving a balance in the fund on June 30, 1946, of $47,895,107. Repayments of construction charges to the Reclamation fund during the fiscal year 1946 totaled $2,951,839. Operation and maintenance collections totaled $1,653,809, of which $397,957 accrued to the Reclamation fund. Receipts from water rentals, power sales, and other sources aggregated $18,938,730, more than twice the receipts for the previous fiscal year.

Decentralization of Accounting

During the fiscal year the Director of Finance authorized a study of the Bureau of Reclamation accounting system and procedure with a view of streamlining the accounting and developing procedure for current reporting. At the close of this fiscal year an improved plan of control has been devised, and the entire accounting is being decentralized into regional offices, with cash control being maintained in the Washington office. The plan of decentralization of the accounting should result in a more effective control and current reporting for all projects within each region. This plan will also facilitate the preparation of consolidated reports on a monthly basis, so that the financial position will be currently available for individual projects as well as the over-all operations of the Bureau.

Reclamation Legislation

With the close of the fiscal year 1946, proposed legislation of far-reaching significance to Reclamation was pending before the Seventy-ninth Congress. Proposed legislation included House bills 520 and 5124. House bill 520 would "facilitate settlement of returning veterans on farms in projects constructed, operated, and maintained by the Bureau of Reclamation." Extensive hearings were held by the House Committee on Irrigation and Reclamation on House bill 5124, a bill "Relating to the sale of electric power and power privileges under the Reclamation Project Act of 1939." Former Secretary Ickes recommended enactment of the bill with certain amendments. One of the amendments would authorize the Secretary of the Interior, whenever opportunities arise in connection with Federal reclamation projects, to improve conditions for fish and wildlife and to provide recreational facilities on a nonreimbursable basis. The Solicitor of the Department, the Commissioner of Reclamation, the Director of the Fish and Wildlife Service, and the Associate Director of the National Park Service appeared before the Committee.

The act of July 14, 1945 (Public Law 143, 79th Cong., 1st sess.), authorized the Secretary of the Interior to execute a contract between the United States and the Truckee-Carson irrigation district. This contract authorized the payment of the deficit of the district from funds received from water rights sold after January 1, 1942.

An amendment (act of Mar. 6, 1946, 60 Stat. 36) to section 9 of the Boulder Canyon Project Act (45 Stat. 1057) renewed and extended to veterans of World War I, the Spanish-American War, and veterans of the insurrection in the Philippines, the veterans' preference in connection with the opening of public lands to homestead entry on lands watered from the Gila Canal in Arizona and the All-American Canal in California. The act also extended the same preference to veterans of World War II.

The act of June 25, 1946 (Public Law 440, 79th Cong., 2d sess.), amended the act of September 27, 1944 (58 Stat. 747), entitled "An act to allow credit in connection with certain homestead entries for military or naval service rendered during World War II." This amendment extended the benefits of the original act to persons under the age of 21 years who were otherwise qualified.

President Truman signed the War Department Civil Functions Appropriation Act, 1947, on May 2, 1946. On May 3, he issued a statement saying he was "glad to note that the Congress, by the addition of certain provisos to the item for the Kings River project, California, has afforded an opportunity for reassuring that the Federal Reclamation policy, including repayment and the wide distribution of benefits, will apply to that project." The President further added that in the near future he planned to send to the Congress his recommendations regarding an over-all plan for the development of the water resources of the Central Valley area in California. In the meantime, President Truman instructed the Director of the Budget to impound the funds appropriated for the construction of the Kings River project, California, pending determination of the allocation of costs and the making of the necessary repayment arrangements.

The Congress approved an interstate compact between the States of Colorado and New Mexico with respect to the waters of the Costilla Creek (act of June 11, 1946, Public Law 408, 79th Cong., 2d sess.).

Public Law 439, Seventy-ninth Congress, second session, authorized the Secretary of the Interior to convey approximately 10 acres of land, heretofore withdrawn for reclamation purposes, to the Boulder City Cemetery Association for use as a cemetery.

Squatters on the public lands within the boundaries of the Anderson Ranch Reservoir site, Boise project, Idaho, will receive equitable relief under the act of June 26, 1944 (Public Law 450, 79th Cong., 2d sess.).

The Bureau of Reclamation's authority on the Colorado River was broadened by the act of June 28, 1946 (Public Law 469, 79th Cong., 2d sess.).

Personnel Recruitment and Training

Appointing authority to the Bureau of Reclamation was increased by the Secretary during the year just ended until it now includes all positions in the field service in grades CAF–13 and P–6 and below, with the exception of policy making and major supervisory positions. All this appointing authority was delegated by the Commissioner to the Chief Personnel Officer and, with certain limitations, to the regional offices.

During the past year, several new personnel services were initiated, including Bureau-wide standard employment practices and the launching of labor relations and safety programs. As these additional functions became organized, the appointing authority of the regions was increased to include

CAF–11 and P–4. By this action, approximately 95 percent of the personnel matters can be handled conclusively at their source, resulting in more rapid and efficient management of personnel.

The Office of the Chief Personnel Officer was charged with the responsibility of anticipating the personnel needs to meet the post-war programming of the Bureau. The number of Reclamation employees increased from 7,033 on June 30, 1945, to 14,362, June 30, 1946.

Veterans Fill New Positions

In collaboration with the Personnel Supervision and Management Division of the Office of the Secretary, plans were made effectively to administer the Veterans Preference Act of 1944. By the end of the fiscal year, with the rapid demobilization of the armed forces, practically all positions were being filled by veterans.

At the close of the fiscal year the Personnel Office was proceeding with the heavy responsibility of developing a staff of personnel to meet an unprecedented Reclamation program. Plans were outlined to employ several thousand technical and specialized engineers in the fields of hydrology, structural, mechanical, electrical, and civil engineering. Also being selected are economists, project planners, superintendents, and inspectors. Administrators capable of coordinating the planning and organization of such a program were recruited primarily by promotion from the nucleus staff maintained by the Bureau throughout the war and from former personnel returned from military service.

Employee Development Plans

Many long-range, practical training programs for Bureau employees have been initiated. The Guide to Employee Training, a handbook for new employees, has been published and is in use throughout the Bureau. Specialized needs of the Bureau required the undertaking of training to provide qualified chief clerks, concrete inspectors, and materials inspectors, and other types of employees. Training for disabled veterans has been authorized in an on-the-job basis within the Bureau, as well as job training for those employees eligible for benefits under the GI bill. Arrangements, on a cooperative basis between interested colleges and the Bureau, have been put into effect for employees to pursue a work-study plan. All of these plans are designed to attract and build a more productive staff.

During the past year there has been established in the Office of the Chief Personnel Officer a Central Board of United States Civil Service Examiners for the Bureau of Reclamation. As a central examining medium, this board operates within its stipulated function as a single agency for the purpose of serving the entire field service of the Bureau. The board has the responsibility for holding examinations, establishing registers, and certifying employees to positions in the field service of the Bureau. This function is executed in those specialized or technical fields peculiar to the agency, particularly for those which recruitment is to be made and registers established on a Nation-wide basis.

The Branches of Project Planning and Power Utilization and the Offices of Personnel and Finance were transferred to Washington during the fiscal year.

Personnel Changes

Notable among changes in the Bureau's top ranking personnel during the past year was the appointment of Michael W. Straus as Commissioner to succeed Harry W. Bashore, who retired after 39 years of service in the Bureau. Other important changes were the appointment of Richard L. Boke as Regional Director of region 2, Sacramento, Calif., to succeed Charles W. Carey, deceased, and the promotion of Assistant Regional Director R. J. Newell, region 1, Boise, Idaho, to fill the vacancy of Regional Director created by the transfer of Frank A. Banks to the Columbia Basin project as supervising engineer.

International Cooperation

In the interest of scientific and cultural cooperation the Bureau has made available design and construction methods to many foreign governments through technical papers, by visits of foreign engineers and technicians to Bureau projects and offices and through facilities of the Bureau training program. During the past year 219 requests for technical literature were received and 194 engineers and technicians from 29 foreign countries made 362 visits to the design and construction offices and projects. Of this number 35 engineers took extensive training in the design and construction offices and 20 of these completed a full year's work.

William L. Newmeyer, Chief of the Bureau's Resources and Development Division, was sent to Greece as a member of a special mission of the United Nations Food and Agricultural Organization to make a comprehensive study of the resources development possibilities and make a report for a program of reconstruction and economic development there.

In addition to this interest in the Bureau's technical accomplishments, representatives of foreign governments have displayed great interest in the Bureau's organization structure and administrative techniques. Organizational and administrative information have been provided for virtually all foreign governments concerned with irrigation and hydroelectric power developments.

Division of Power

ARTHUR GOLDSCHMIDT, *Director*

THE Division of Power has the responsibility of supervising and promoting the efficient coordination of the power activities of the Department which include the Bonneville Power Administration, the Bureau of Reclamation, the Southwestern Power Administration, the Office of Indian Affairs, and the National Park Service. The shift in emphasis from the production of war materials and munitions to peacetime production has brought about an increasing number of complex problems and this has added materially to the work of the Division. Power from federally constructed projects which had formerly played such an important part in the prosecution of the successful war against the Axis Nations was suddenly made available for peacetime purposes. The marketing of this power in accordance with the public power policy as declared by the Congress has been of major concern to the Division.

The work load of the Division was further augmented in view of the additional responsibilities which were placed upon the Secretary by the Flood Control Act of 1944 and the River and Harbor Act of 1945. The Secretary has the responsibility of transmitting and marketing all excess power generated at reservoir projects constructed by the Corps of Engineers of the War Department. As of June 30, 1946, the ultimate installed capacity of these authorized projects is to be more than 7,200,000 kilowatts. In addition, the installed capacity of projects authorized to be constructed by the Bureau of Reclamation is to be 1,408,400 kilowatts, making a grand total of ultimate capacity of projects thus far authorized of 8,608,400 kilowatts. This is in addition to the presently installed capacity of 3,107,300 kilowatts at projects from which the Department is now marketing the power. At the present time the Department is operating and marketing power from the largest aggregate of hydroelectric power in the world. This includes power generated at dams operated by the United States Army Corps of Engineers.

The responsibility of the Department of the Interior in the disposal of power is one of great magnitude. During the 1946 fiscal year 15 billion killowatt-hours of saleable energy were delivered by the generating plants from which the Department marketed the power, as compared to 18 billion killowatt-hours during the preceding fiscal year.

Marketing studies.—It was anticipated that upon the cessation of hostilities there would be a decided drop in the use of electrical energy due to the closing of the many war plants as vast quantities were used in the production of aluminum, magnesium, and other light metals. However, generally the loads are holding up exceptionally well. The shutting down of the aluminum plants did curtail the use of power marketed by the Bonneville Power Administration and the Southwestern Power Administration, but arrangements are now being made to put some of these plants back into operation on a peacetime basis when they will again require even larger amounts of electrical energy.

Studies are going forward as rapidly as possible in order to ascertain how best the electrical energy from authorized flood control and river and harbor projects, as well as from those now under construction, can be disposed of in compliance with the Federal power policy which is, in effect, that the benefits of this power shall not be monopolized by limited groups, but shall be so distributed as to enhance the domestic, agricultural and industrial phases of our national economy.

These studies are being made by the Bonneville Power Administration, the Bureau of Reclamation, and the Southwestern Power Administration in their respective areas of operation, and by the Division of Power for those projects outside of the above areas. In the Southeast for instance, the Division has given particular attention to six projects for which funds have been appropriated and which are now in process of construction. They will have an ultimate installed capacity of 1,057,000 kilowatts.

All of these studies are necessary to determine the most feasible method for making available to the people of the various areas the maximum benefits from these projects at a minimum cost. They involve the orderly river basin development, the scheduling of construction features, the reconversion of the war plants, the allocation of costs, and the planning of facilities necessary to market the power generated at the various projects.

If continued, the present high costs of construction, which are believed to be abnormal, would prevent the construction of many flood control, navigation and irrigationn dams which are justified on a basis of monetary costs and benefits, and would increase the cost of incidental power in some cases to the point where the regions affected would be benefited very little. The Division's studies of construction costs show some postwar correlation with both volume and real national income per capita. They indicate that immediate postwar construction costs are likely to be higher than those in subsequent years, but that construction cost levels otherwise are not usually lowered unless both volume of private construction and real income drop for two successive years.

In order that there may be proper coordination of Federal functions and activities with respect to multiple-purpose river basin developments between the Federal agencies involved, a close working relationship is being developed with the Corps of Engineers of the War Department and with the

Federal Power Commission. This relationship has to do with scheduling of installations at power plants, size and characteristics of generating units, design of substations and controls, markets available, and determination of costs of projects for rate purposes. This work is carried on in part through subcommittees of the Inter-Agency River Basin Committee which consists of representatives of the Federal Power Commission, the War Department, the Department of Agriculture, and the Department of the Interior.

In addition, the Division is working very closely with the Rural Electrification Administration in order that the benefits from these federally constructed developments may be made available to present and future rural consumers. At the present time 37 REA-financed projects are being supplied with power from these projects at rates ranging down to less than 3½ mills a kilowatt-hour. As construction materials become more plentiful, a marked increase in the amount of energy purchased by these cooperatives from the Federal projects will undoubtedly occur as a large number of additional REA projects will be under way as rapidly as materials become available.

Rates and rate schedules.—The Division reviewed a number of major rate studies during the past year. It actively participated in the over-all rate study made by the Bonneville Power Administration, as well as in the rate study which was included in the comprehensive report of the Southwestern Power Administration. It reviewed new rates proposed by the Bonneville Power Administration, such as rates for railroad electrification, secondary energy, and irrigation pumping. Reviews were also made of the proposed changes in the governing provisions of Bonneville's basic kilowatt-year rate.

Power contracts.—Due to the change from wartime to peacetime operations, a large number of contracts have been modified and many new ones proposed to service new industries, all of which of any importance policy-wise have been reviewed by the Division.

Grand River Dam project.—With the surrender of Japan in August 1945, steps were taken to arrange for a return to the Grand River Dam authority, an agency of the State of Oklahoma, of the Grand River Dam project which had been taken over in 1941 by the Federal Government and, through the Southwestern Power Administration, was being operated for war purposes. Section 16 of the Federal Power Act provided a formula for a return of the project and a settlement of accounts arising out of its occupation and use by the Government. However, a satisfactory settlement under this provision would have been severely complicated by the fact that construction of the project by the authority had been financed entirely pursuant to an incompletely performed loan and grant agreement between the authority and the Government, that the Government had made extensive additions to the authority's properties, and that the authority's indebtedness to the Government needed refinancing. In these circumstances it was felt by the authority and the Department of the Interior that a negotiated agreement under new legislation would afford the most practicable means for an equitable and speedy settlement of accounts and the establishment and maintenance of operations by the authority on a sound financial basis. Proposed legislation providing for such an agreement, drafted by the Division after consultation with the authority and interested Federal agencies was passed by the House of Representatives and was pending before the Senate at the close of the fiscal year. Pending enactment of this legislation, the Division of Power directed and, to a considerable extent, participated in negotiations between the authority and the Southwestern Power Administration which resulted in a tentative agreement on all matters involved. Execution and performance of the agreement could be effected within a short time after enactment of enabling legislation.

Miscellaneous.—The Division cooperated in further studies and negotiations of the Bureau of Reclamation for the proposed acquisition of the rights of the Salt River Valley Water Users' Association in the power system of the Salt River project in Arizona, and made further studies of the proposal for acquiring the rights of the Minidoka and Burley irrigation districts in the Minidoka power system in Idaho.

The Division also independently assisted and cooperated with the Bureau in its efforts to assist the Arizona Power Authority, created by the State Legislature in 1944, in making plans and arrangements for marketing Arizona's share of the power developed at Boulder, Parker, and Davis Dams on the Colorado River.

The Division worked with the Bonneville Power Administration in the preparation of its report to the Congress showing a complete pay-out of all the power costs at the Bonneville and Grand Coulee projects and of its transmission lines at the present basic $17.50 rate per kilowatt.

The Division has worked with the Territorial Governments of Puerto Rico and of the Virgin Islands in connection with their power problems. Assistance was given to the Puerto Rico Water Resources Authority in negotiating a 5-year lease with the Navy for the naval power plant at Roosevelt Roads and in negotiating the purchase of a 30,000 kilowatt floating power plant, declared surplus by the Army and sold to the Authority by the War Assets Corporation, for $2,500,000. The authority was also aided in securing other surplus power equipment.

At the request of the Governor of the Virgin Islands, special studies were undertaken and recommendations made for the modernization of the inadequate and antequated direct current systems of the islands of St. Thomas and St. Croix which were constructed when the islands were under Danish rule. As a result of these recommendations, legislation has been enacted and appropriations made by the Territorial Councils providing for the construction of modern alternating current systems.

A preliminary survey of the hydroelectric power possibilities in Alaska was initiated by the Division.

Bonneville Power Administration

PAUL J. RAVER, *Administrator*

THE year ending June 30, 1946, brought numerous unusual developments for the Bonneville Power Administration. With the cessation of hostilities and the consequent shutting down of many war industries, there was every reason to expect a drastic cut-back in power use. Indeed, the closing of the light metals plants in the Pacific Northwest did cancel more than 425,000 kilowatts. Plans in the earlier part of the year had been based on the possibility of a power surplus of some magnitude, and every measure was taken for finding or creating other outlets for the relinquished war load.

The surplus did materialize on the scale expected but was of very short duration. A sudden and decided upswing in the loads of retail distributors, due to increased consumer demand, occurred almost immediately following the close of the war. A great part of the war load came back to the Administration sooner than had been expected, both in various war-born industries and particularly in the resumption of the use of large blocks of power for aluminum production in Government plants leased to private industrialists.

The outcome of this unexpected reversal was that by the end of the fiscal year the Administration found itself with its surplus practically all contracted for and with a threatened shortage of power impending for a number of years in the future.

Revenues

Shut-down of war industries with the resultant cut-backs in the demand for power during fiscal year 1946 brought a temporary decline of Bonneville Power Administration revenues during the early part of the year. Revenues for sales of Bonneville and Grand Coulee power during the year were $19,882,785, a decrease of 13½ percent from the peak reached in the preceding year. However, the latter part of 1946 showed sharp recovery in revenues, as power demands of distribution agencies and industries increased to the point where a definite shortage of supply threatened.

As will be seen in table 1, revenues by class of customer, the principal decrease in income was in the aluminum industry. But the reductions are reflected in most other categories of customers since the Administration had been supplying a large part of the war-industry load in the region.

TABLE 1.—*Revenue by class of customer, fiscal years 1939–46*

Class of customer	1940 and prior	1941	1942	1943
Industry:				
Aluminum		$1, 075, 809	$3, 770, 767	$7, 514, 122
Other industry	$275	12, 899	243, 726	1, 284, 588
Military establishments		254	11, 860	182, 156
Publicly owned utilities	12, 347	119, 659	411, 146	1, 230, 740
Privately owned utilities	413, 922	686, 882	882, 820	1, 767, 866
Other electric revenue		120	27, 692	41, 646
Total operating revenue	426, 544	1, 895, 623	5, 348, 011	12, 021, 118

Class of customer	1944	1945	1946	Total to June 30, 1946	1946 percentage (dollars revenue)
Industry:					
Aluminum	$11, 989, 735	$11, 838, 156	$7, 987, 226	$44, 175, 815	40. 17
Other industry	2, 976, 947	3, 780, 727	2, 810, 662	11, 109, 824	14. 14
Military establishments	472, 789	390, 742	298, 087	1, 355, 888	1. 50
Publicly owned utilities	1, 994, 750	2, 141, 635	1, 711, 822	7, 622, 099	8. 61
Privately owned utilities	3, 401, 042	4, 752, 021	5, 207, 844	17, 112, 397	26. 19
Other electric revenue	60, 665	86, 737	[1] 1, 867, 144	2, 084, 004	9. 39
Total operating revenue	20, 895, 928	22, 990, 018	19, 882, 785	83, 460, 027	100. 00

[1] This includes $1,789,443 of contract cancelations applicable to fiscal year 1946. (The total of $3,802,415 is apportioned over a period of 12 months.)

Total revenues for all operations from 1939 to June 30, 1946, were $83,460,027. As of that date the Administration had collected and deposited in the United States Treasury power revenue receipts totaling $78,164,232, and general fund receipts of $1,070,845. Accounts receivable, excluding $2,012,972 for unamortized cancelation charges, accrued unbilled revenues, unbilled exchange power sales, miscellaneous adjustments, and minor items account for the difference between total revenues and total receipts deposited with the United States Treasury.

Energy Production

The dams at Bonneville and Grand Coulee produced a total of 6,236,163,280 kilowatt-hours during fiscal year 1946. Energy deliveries to customers by the Administration were 6.9 percent less than this, a difference accounted for by transmission system losses. Table 2, generation at Bonneville and Grand Coulee Dams, shows the energy production from 1938 to the present, while table 3, electric energy account, gives in detail the explanation of energy received and energy delivered by the Administration.

TABLE 2.—*Bonneville Power Administration generation at Bonneville and Grand Coulee plants, 1938–46*

Fiscal years ending June 30	Bonneville Dam generation	Grand Coulee Dam generation	Total generation for BPA
	Kilowatt-hours	*Kilowatt-hours*	*Kilowatt-hours*
1939	34, 874, 138		34, 874, 138
1940	208, 426, 077		208, 426, 077
1941	894, 177, 000	7, 455, 000	901, 632, 000
1942	1, 807, 309, 000	741, 844, 249	2, 549, 153, 249
1943	2, 801, 480, 400	2, 816, 955, 729	5, 618, 436, 129
1944	3, 488, 873, 992	5, 750, 949, 460	9, 239, 823, 452
1945	3, 391, 127, 400	5, 660, 445, 960	9, 051, 573, 360
1946	2, 674, 834, 000	3, 561, 329, 280	6, 236, 163, 280
Total	15, 301, 102, 007	18, 538, 979, 678	33, 840, 081, 685

TABLE 3.—*Bonneville Power Administration electric energy account, fiscal year ending June 30, 1946*

Energy received—(kilowatt-hour):	
Energy generated for Bonneville Power Administration:	
Bonneville	2, 674, 834, 000
Grand Coulee	3, 561, 329, 280
Total	6, 236, 163, 280
Power purchased and interchanged in	291, 092, 650
Total received	6, 527, 255, 930
Energy delivered—(kilowatt-hour):	
Sales	5, 831, 146, 509
Power interchanged out	234, 928, 976
Used by administration	12, 659, 567
Total delivered	6, 078, 735, 052
Energy losses	448, 520, 878
Percent of total energy received	6. 9
Maximum demand on Bonneville and Grand Coulee plants (kilowatt), Aug. 28, 1945, 11–12 a. m	1, 346, 000
Load factor—total generated for Bonneville Power Administration	52. 9

The installed capacity at the Bonneville and Grand Coulee plants suffered a reduction of about 150,000 kilowatts during fiscal year 1946 by the removal of two generators originally built for Shasta Dam which had been installed at Grand Coulee during the period of pressing war demand to meet the requirements of industrial and military establishments in this region. The total installed capacity at the two Columbia River dams is now 1,176,400 kilowatts. The accompanying graph shows the development of installed generator capacity (name plate rating) at the Bonneville and Grand Coulee plants for the fiscal years 1938 through 1946.

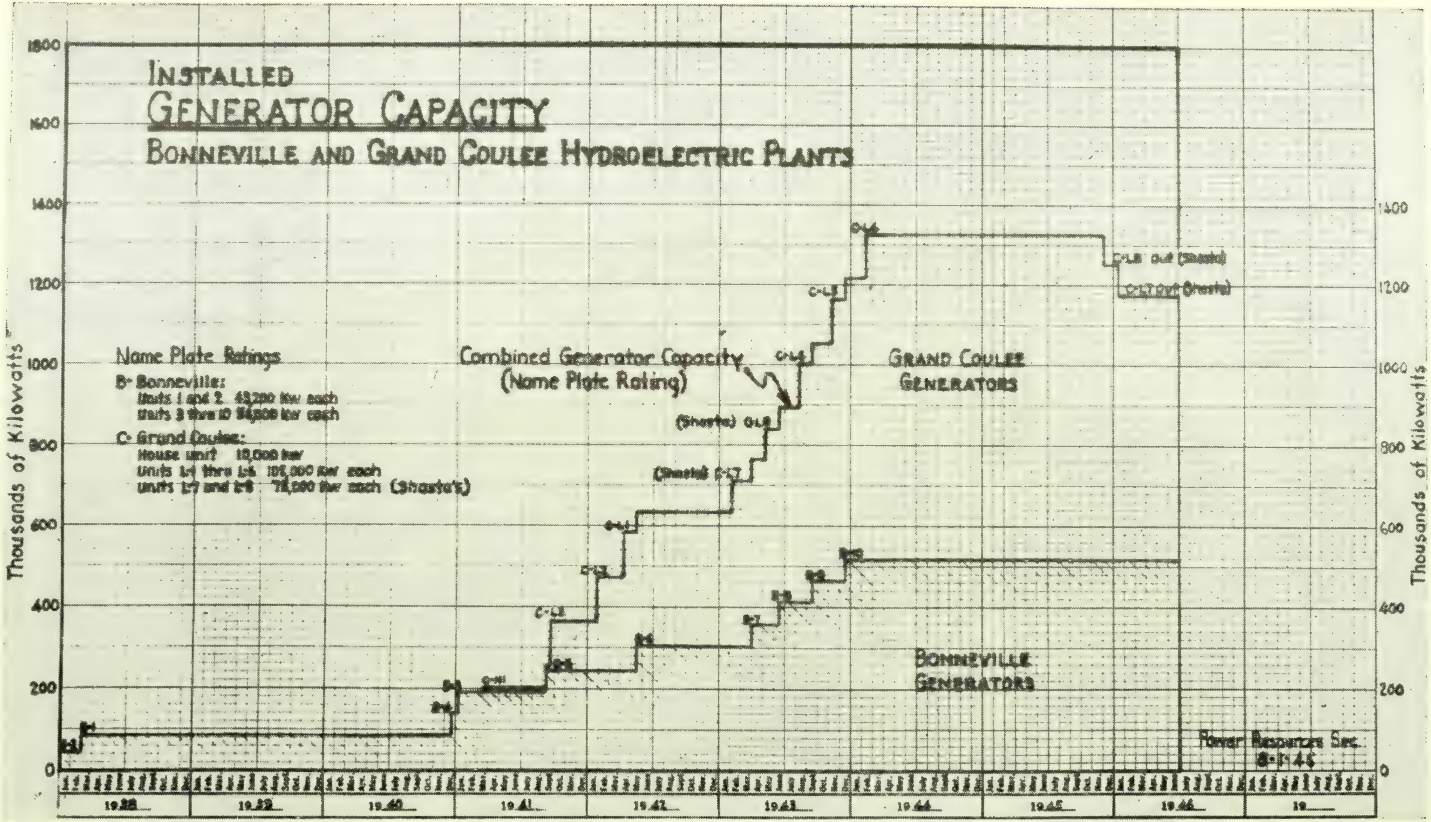
INSTALLED
GENERATOR CAPACITY
BONNEVILLE AND GRAND COULEE HYDROELECTRIC PLANTS
Name Plate Ratings
B- Bonneville:
Units 1 and 2 43,200 kw each
Units 3 thru 10 54,000 kw each
C- Grand Coulee:
House unit 10,000 kw
Units L-1 thru L-6 108,000 kw each
Units L-7 and L-8 75,000 kw each (Shasta's)
Combined Generator Capacity
(Name Plate Rating)
GRAND COULEE
GENERATORS
BONNEVILLE
GENERATORS
C-L6
C-L5
C-L4
(Shasta) C-L8
(Shasta) C-L7
C-L8 out (Shasta)
C-L7 out (Shasta)
C-L1
C-L2
C-L3
B-10
B-9
B-8
B-7
B-6
B-5
B-4
B-3
B-2
B-1
Power Resources Sec.
8-1-46
Thousands of Kilowatts
Thousands of Kilowatts
0
200
400
600
800
1000
1200
1400
1600
1800
1938
1939
1940
1941
1942
1943
1944
1945
1946
19

FIGURE 1.

The installed capacity of all the major power systems now serving the load areas of Oregon, Washington, Idaho, Montana, and Utah is 3,134,000 kilowatts, of which 2,785,000 kilowatts is hydroelectric. The balance, 349,000 kilowatts, is steam-electric capacity of which 101,000 kilowatts is high cost generation. Operating utilities of the Northwest are interconnected by system transmission facilities with the Bonneville Power Administration system, which forms the backbone of the Pacific Northwest's power pool.

The combined output of the major publicly owned systems—the Bonneville-Grand Coulee, Tacoma, and Seattle systems—was 7.8 billion kilowatt-hours in fiscal year 1946, which was 52 percent of the total generation of the combined power systems of the Northwest. The total combined generation of all utilities in the system during that year was just over 15 billion kilowatt-hours. Table 4 presents the actual generation in fiscal 1946 by the various electric systems of the Northwest interconnected systems.

TABLE 4.—*Actual generation by the electric utility systems of the Pacific Northwest—Northwest interconnected systems, fiscal year 1946*

Utilities	Billions of kilowatt-hours	Percent of total generation
Publicly owned:		
Bonneville Power Administration	6.2	41.1
Seattle City Light System	.9	6.0
Tacoma City Light System	.7	4.6
Total publicly owned	7.8	51.7
Privately owned:		
Puget Sound Power & Light Co	1.5	9.9
Washington-Pacific System	1.5	9.9
Northwestern Electric Co	.4	2.7
Portland General Electric Co	.5	3.3
Montana Power Co	2.1	13.9
Utah Power & Light Co	.5	3.3
Idaho Power Co	.8	5.3
Total privately owned	7.3	48.3
Total Northwest interconnected systems	15.1	100.0

By the end of the fiscal year the load of the Pacific Northwest was increasing so rapidly that during the coming winter season the available generating capacity is expected to be barely sufficient to carry the load. During the past 5 years the Bonneville Power Administration and the municipally owned utilities of Seattle and Tacoma have brought new generation into the area. These three systems now have a number of projects under construction which should help to relieve the growing power shortage. Seattle is increasing storage capacity at Ruby Reservoir which will increase the generation at its Diablo and Gorge plants. Tacoma has recently completed installations which have added 65,000 kilowatts of new capacity, and is in process of installing 25,000 kilowatts more.

TABLE 5.—*General specifications—authorized and unauthorized projects*

	Location	Proposed installation	Prime power	Pool elevation	Usable storage	Average head	Purpose
AUTHORIZED PROJECTS [1]		*Kilowatts*	*Kilowatts*	*Feet*	*Acre-feet*	*Feet*	
1. Grand Coulee [1]	Washington	1,944,000	[2] 1,164,000	1,288.0	5,200,000	321.0	Irrigation, power, storage, and navigation.
2. McNary	Oregon	828,000	[2] 465,900	340.0		82.0	Navigation and power.
3. Foster Creek	Washington	1,024,000	[2] 610,500	937.5		172.9	Power and irrigation.
4. Hungry Horse	Montana	142,000	125,600	3,517.0	[3] 1,500,000	442.0	Storage and power.
5. Lower Snake site No. 1	Washington	66,000	51,500	385.0		45.0	Navigation and power.
6. Lower Snake site No. 2	do	112,000	86,300	460.0		75.0	Do.
7. Lower Snake site No. 3	do	112,000	86,300	535.0		75.0	Do.
8. Lower Snake site No. 4	do	74,000	57,400	585.0		50.0	Do.
9. Lower Snake site No. 5	do	90,000	69,100	645.0		60.0	Do.
10. Lower Snake site No. 6	do	104,000	80,400	715.0		70.0	Do.
11. Garden Valley	Idaho	45,000	(4)	3,240.0	1,250,000	280.0	Irrigation and power.
12. Upper Scriver Creek	do	30,000	23,740	4,505.0		390.0	Do.
13. Lower Scriver Creek	do	90,000	46,920	4,060.0		770.0	Do.
14. Palisades	do	30,000	14,950		1,300,000	144.0	Flood control, irrigation, and power.
15. Detroit	Oregon	45,000	25,300	1,569.0	339,500	371.0	Flood control, navigation, and power.
UNAUTHORIZED PROJECTS [5]							
1. The Dalles	do	829,400	[2] 456,600	160.0		87.0	Navigation and power.

[1] 6 of ultimate 18 units are now in operation, 3 units are being manufactured and bids have been asked for 3 additional units.
[2] Generation includes benefit from 1.5 million acre-feet of storage at Hungry Horse.
[3] Preliminary study; final usable storage will probably be in excess of this amount.
[4] Secondary power only.
[5] Should follow construction of Foster Creek project.

In the Bonneville-Grand Coulee system, Bonneville Dam is already complete. Three new units are under construction for installation at Grand Coulee Dam by the Bureau of Reclamation, and bids have been asked for three more such units. These will provide an important addition to the power supply available to the Bonneville Power Administration.

The only improvement under construction by a private utility is a 16,500 kilowatt development by the Idaho Power Co., scheduled for completion in December 1946.

Many projects will eventually be required for the full development of Columbia River potentialities and of Pacific Northwest resources. Table 5 lists the major authorized projects, plus the projected dam at The Dalles, on all of which construction is expected to start during the next few years, and whose output is essential to meet the growing Pacific Northwest loads.

The tentative installation schedule is as follows:

McNary: 3 units in 1952; 4 in 1953; 3 in 1954; and final 2 in 1955.

Foster Creek: 3 units in 1953; 4 in 1954; 2 each in 1955, 1956, 1957, 1958; and final one in 1959.

Detroit: One unit in 1951.

Lower Snake Plants: Development will begin in 1952 and be concluded in 1956.

The Dalles: (not authorized). Begin in 1956, and 11 units by 1959.

Grand Coulee: Unit No. 7 in November 1947; No. 8 and No. 9 in 1949; Nos. 10, 11, 12 in 1949; Nos. 13, 14, 15 in 1950.

Hungary Horse: Schedule and plans to be jointly determined by Bonneville Power Administration and Bureau of Reclamation.

The schedule has been arranged to meet the estimated growth of loads in the region but even strict adherence to it will not prevent a threatened shortage of power. Unwarranted delay in the development of essential projects can only result in dislocation of the normal economic growth of the Northwest with perhaps fatal effects to industrial developments, employment, population growth, and general well-being.

Energy Deliveries

Energy deliveries to customers for the fiscal year 1946 over the Administration's transmission system amounted to 5,831,147,000 kilowatt-hours. Total energy deliveries from the time the Administration's system first began to function are 31,810,204,000 kilowatt-hours. Table 6, electric energy sales by class of customer, shows the energy deliveries for the 8 years of the Administration's life.

TABLE 6.—*Electric energy sales by class of customer,*[1] *fiscal years 1939–4*

Class of customer	1939	1940	1941	1942	1943	1944	1945	1946	Total to June 30, 1946
Industry:	*MWH*	*MWH*	*MWH*	*MWH*	*MWH*	*MWH*	*MWH*	*MWH*	*MWH*
Aluminum	--------	--------	522, 982	1, 845, 249	3, 588, 848	5, 453, 893	4, 667, 381	2, 538, 590	18, 616, 94
Other industry	--------	21	4, 790	76, 580	464, 309	934, 588	878, 896	693, 795	3, 052, 97
Military establishments	--------	--------	18	2, 575	42, 887	87, 889	85, 828	59, 970	279, 16
Publicly-owned utilities	7	3, 101	32, 134	142, 491	435, 289	727, 642	823, 817	635, 284	2, 799, 76
Privately-owned utilities	30, 036	188, 806	317, 713	357, 704	739, 076	1, 467, 304	2, 057, 203	1, 903, 508	7, 061, 35
Total	30, 043	191, 928	877, 637	2, 424, 599	5, 270, 409	8, 671, 316	8, 513, 125	5, 831, 147	31, 810, 20

[1] Includes sales under exchange agreements.

The yearly system peak occurred on August 28, 1945, during the hour 11 a. m. to 12 noon, when the demand reached 1,346,000 kilowatts. This exceeded the rated generating capacity of 1,326,400 kilowatts by 1.5 percent. The next highest peak came on August 31, 1945 from 9 a. m. to 10 a. m. with a demand of 1,312,000 kilowatts. These peaks occurred in August after the surrender of Japan but while industries were still operating on a wartime basis. In the following month aluminum production was curtailed and the demands on the Bonneville system became lower.

During the fiscal year the Administration served 84 wholesale customers, of which 48 are publicly owned utilities, 6 are privately owned utilities, 11 are military establishments, and 19 are industries. Eight new customers were added during the year with a total maximum demand in June 1946 of 19,857 kilowatts. Four establishments closely allied to the war effort discontinued their demand. Eleven additional delivery points for existing customers were established with a total maximum demand in June 1946 of 9,872 kilowatts.

Transmission System

At the end of fiscal year 1946 Bonneville Power Administration had in operation 2,850 circuit miles of transmission lines and 62 substations. The transmission system consisted of 1,287 miles of 230-kilovolt line; 1,142 miles of 115 kilovolts and 410 miles of lower voltages.

A total of 115.6 circuit miles of transmission lines of all types was placed in service during the fiscal year. This included 50.9 miles of 230-kilovolt line, 6.2 miles of 115-kilovolt line and 57.4 miles of lower voltage line.

The most important construction job of the year was the completion of the 51-mile 230,000-volt Midway-Columbia line and the placing in service of the Columbia substation. The effectiveness of these facilities in strengthening the system was demonstrated during an unscheduled complete shutdown of the Grand Coulee powerhouse on March 11, 1946. The Administration's main 230-kilovolt loop was broken at Grand Coulee, but the new Columbia-Midway line bridged the gap.

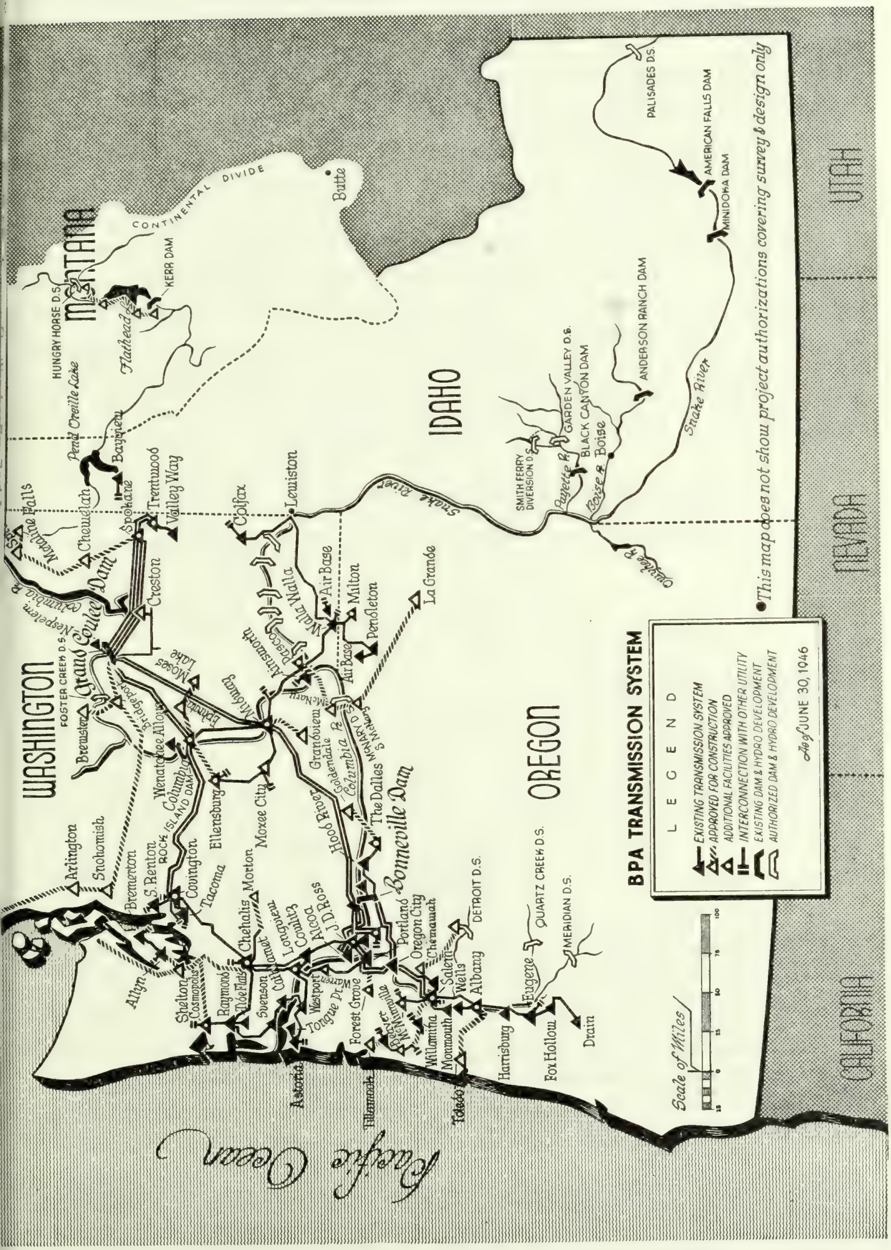
BPA TRANSMISSION SYSTEM
LEGEND
EXISTING TRANSMISSION SYSTEM
APPROVED FOR CONSTRUCTION
ADDITIONAL FACILITIES APPROVED
INTERCONNECTION WITH OTHER UTILITY
EXISTING DAM & HYDRO DEVELOPMENT
AUTHORIZED DAM & HYDRO DEVELOPMENT
As of JUNE 30, 1946
Scale of Miles
0
25
50
75
100
•This map does not show project authorizations covering survey & design only
WASHINGTON
OREGON
IDAHO
MONTANA
UTAH
NEVADA
CALIFORNIA
Pacific Ocean
CONTINENTAL DIVIDE
Grand Coulee Dam
Bonneville Dam
Columbia R.
Snake River
Foster Creek D.S.
Brewster
Bridgeport
Nespelem
Moses Lake
Ephrata
Wenatchee
Columbia
Rock Island Dam
Ellensburg
Moxee City
Midway
Grandview
Goldendale
The Dalles
McNary D.S.
McNary
Hood River
Ainsworth
Pasco
Walla Walla
Air Base
Milton
Pendleton
La Grande
Colfax
Lewiston
Creston
Spokane
Trentwood
Valley Way
Chewelah
Metaline Falls
Pend Oreille Lake
Bayview
Hungry Horse D.S.
Flathead
Kerr Dam
Butte
Arlington
Snohomish
Bremerton
S. Renton
Covington
Tacoma
Allyn
Shelton
Cosmopolis
Raymond
Doe Flats
Svenson
Cathlamet
Chehalis
Morton
Longview
Cowlitz
Alcoa
J.D. Ross
Westport
Tongue Pt.
Astoria
Tillamook
Forest Grove
Warren
Portland
Oregon City
Chemawah
Beaver
McMinnville
Willamina
Monmouth
Salem
Wells
Albany
Toledo
Harrisburg
Eugene
Fox Hollow
Drain
Detroit D.S.
Quartz Creek D.S.
Meridian D.S.
Smith Ferry Diversion D.S.
Garden Valley D.S.
Black Canyon Dam
Payette R.
Boise R.
Boise
Anderson Ranch Dam
Owyhee R.
Minidoka Dam
American Falls Dam
Palisades D.S.

FIGURE 2.

Another important project was the 44-mile 33-kilovolt line from Eugene to Drain, Oreg. This line, with the accompanying transformation and substation facilities, which were also built, serves the public agencies in the area, as well as an agency supplying power for the construction of Dorena Dam.

The total in substation transformer capacities on June 30, 1946, was 2,331,000 kilovolt-amperes, a net increase of 65,500 kilovolt-amperes over the preceding year. Actual new installations total 139,500 kilovolt-amperes. However, 74,000 kilovolt-amperes capacity was removed, a large amount compared to the capacity installed and indicating the unusually large number of transformer shifts required to cope with the postwar up-surge of customer loads. In addition to other installations, 49,500 kilovolt-amperes of transformer capacity was placed in service at the Salem Alumina plant, and a second 35,000 kilovolt-amperes synchronous condenser at Covington substation to provide improved voltage regulation and to increase transmission capability into the Seattle-Tacoma area. Table 7 summarizes the Bonneville Power Administration system additions for the fiscal year.

TABLE 7.—*Bonneville Power Administration system additions*

	Circuit miles			
	230 kilovolts	115 kilovolts	Under 115 kilovolts	Total
Transmission lines:				
Placed in operation 1946 fiscal year	50.9	6.3	57.4	114.6
Removed from operation 1946 fiscal year	−1.7			−1.7
In operation June 30, 1945	1,238.0	1,136.0	352.5	2,726.5
Total operated June 30, 1946	1,287.2	1,142.3	409.9	2,839.4
Leased to others			10.3	10.3
Grand total June 30, 1946	1,287.2	1,142.3	420.2	2,849.7
	Installed at end of 1945 fiscal year	Fiscal year 1946		Installed at end of 1946 fiscal year
		Added	Removed	
Substation facilities operated:				
Transformation kilovolt-amperes	[1] 2,265,133	139,500	74,000	[2] 2,330,633
Static condensers do	59,110			59,110
Synchronous condensers do	252,500	35,000		287,500
Substations number	43	8	1	[3] 50
Switching stations do	11	1		12

[1] Revised to include only facilities in operation. Temporary capacity of 35,334 kilovolt-amperes with portable fans has been deducted.

[2] All transformers in service. No allowance for temporary added capacity with portable fans. Includes 600 kilovolt-amperes owned, but operated by others.

[3] Includes one 600 kilovolt-amperes substation owned, but operated by others.

Despite the end of the war early in the fiscal year, shortages of materials, uncertainty of material deliveries, and the subsequent necessity for changing plans and designs continued to hamper construction progress. Although personnel strength grew during the year, a critical shortage in survey personnel early in the year added to construction problems. Nevertheless construction kept pace with requirements of customers, and in practically all cases service was provided before the customer's facilities were ready.

The year presented no new operating problems. The cut-back in war loads permitted maintenance forces to inspect and repair equipment and lines that were not before this accessible without curtailing essential service. However, by the end of the fiscal year the load was again increasing.

Bonneville Power Administration's 230-kilovolt-amperes system continued to serve as the backbone for the integrated Pacific Northwest electric utility systems generally known as the Pacific Northwest power pool. There was great variability in the energy deliveries by Bonneville Power Administration to the pool utilities, as compared to the steadiness of deliveries to industrial and military customers. In the peak month of August 1945, for example, combined firm and dump power demand of the seven members of the pool which have interconnections with Bonneville Power Administration was 46.4 percent at the system peak hour, as compared to the average 30 percent of energy deliveries made to these utilities during the whole month and during the fiscal year.

The accompanying chart shows graphically the flow of energy during the week of peak power deliveries (ending August 30, 1945) between interconnected systems of the public and private power agencies of the Northwest.

Power and Regional Development

The outstanding industrial development by the end of fiscal year 1946 was the definite assurance of the reopening within a few months by private enterprise of nearly all the war-built aluminum capacity in the Pacific Northwest. These plants will presently absorb nearly all the surplus power that became available late in 1945 upon the curtailment of war production. In addition to this development the demand of the private utilities rose substantially after the close of the war because of an unexpected increase in other industries and in domestic consumption.

The peak wartime demand of the aluminum industry upon the Bonneville Power Administration power system had been about 660,000 kilowatts. Of this approximately 425,000 kilowatts was dropped at the close of the war. Now, through the leasing of Government-owned plants, in accordance with a disposal program in whose formulation the Administration participated, 400,000 kilowatts is again committed to the aluminum industry.

Under authority of the Bonneville Act, which instructs the Administrator to prevent the monopolization of the power supply by limited groups, a policy was established in 1941, to support measures to promote competition in the aluminum industry. The Administration made technical studies of the problems of disposing of the Government aluminum plants to private industry. These studies were used by the Department of Justice in prepar-

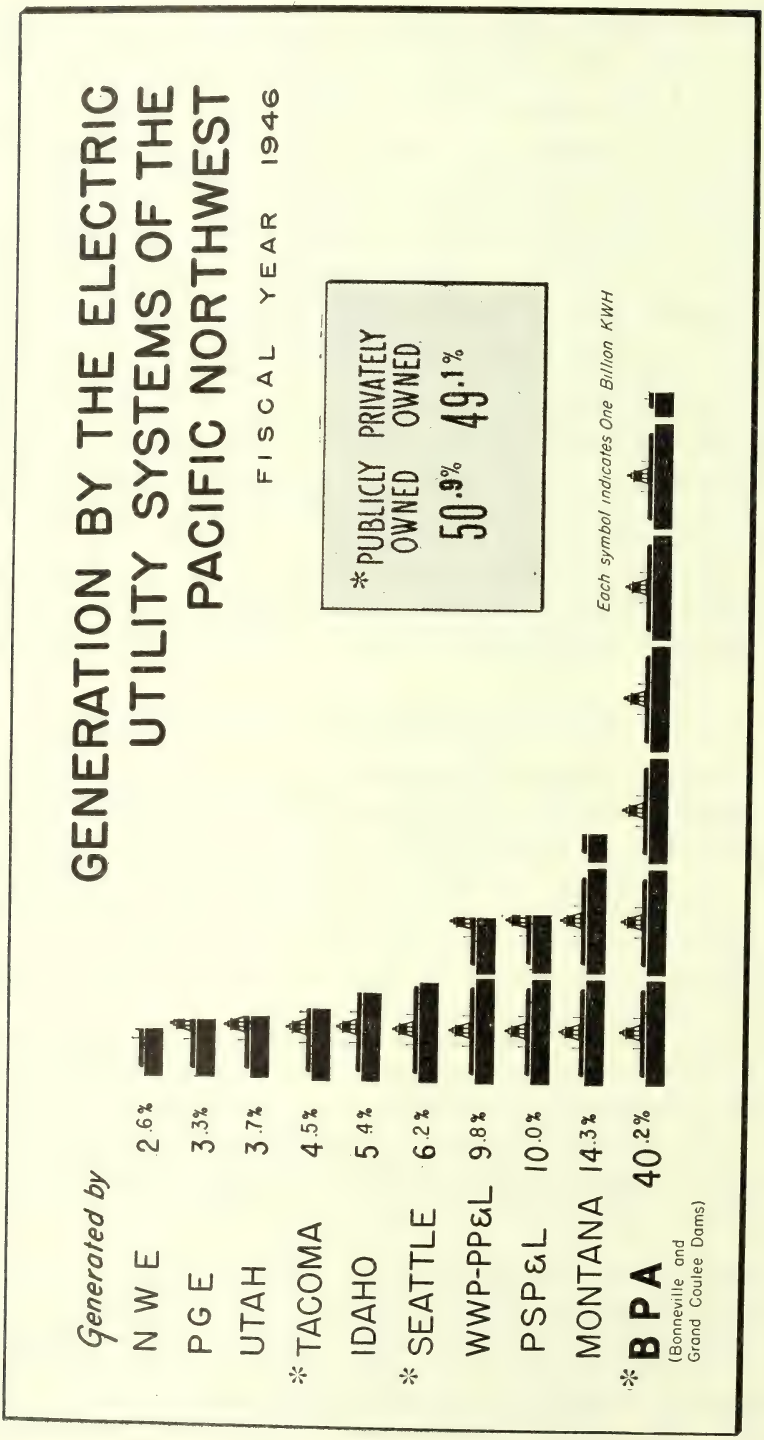
GENERATION BY THE ELECTRIC UTILITY SYSTEMS OF THE PACIFIC NORTHWEST
FISCAL YEAR 1946
*PUBLICLY OWNED 50.9%
PRIVATELY OWNED 49.1%
Each symbol indicates One Billion KWH
Generated by
N W E 2.6%
P G E 3.3%
UTAH 3.7%
*TACOMA 4.5%
IDAHO 5.4%
*SEATTLE 6.2%
WWP-PP&L 9.8%
PSP&L 10.0%
MONTANA 14.3%
*B P A 40.2%
(Bonneville and Grand Coulee Dams)
32902

Figure 3.

ing its report to Congress recommending that the aluminum plants be so disposed of as to foster competition; they were used by the Reconstruction Finance Corporation in the initial stages of its aluminum plant disposal program; they were also used by the Senate Small Business Committee in preparing its report to Congress on the disposal of aluminum and magnesium plants. The studies also led to a request from the Surplus Property Board that the Administration help formulate the aluminum plant disposal program which was later adopted by Congress.

Other developments in the industrial field, while not comparable to those in the aluminum field as far as their contributions to the Administration's revenues are concerned, have created a healthy diversification in the region's economic activity and are helping to establish a desirable pattern of integrated industrial development.

A large-scale electrolytic iron power plant is to be constructed in the Puget Sound area. One of the war-born carbide plants is to continue operations in the region. Expansion is taking place in regional plants producing chlorine and chlorates, chemical bases for insecticides and weedicides. On these and many other potential industrial developments the staff of the Administration has been in consultation with industry.

In the field of transportation efforts toward the electrification of western railroads resulted in the preparation of a power rate particularly designed to make such electrification feasible. This rate has been submitted to the Federal Power Commission for approval.

To plan for peacetime developments and the extension of residential, rural, and commercial markets for power that would help to take up the cancelled war load, the Administration reactivated its customer utilization section in November 1945. An educational and sales promotion program was designed to widen these markets and to increase utilization by present customers.

The war accelerated a substantial number of new uses for electric power and it is believed that these will continue. The unexpected rise in domestic load, following the end of the war, substantiates this belief. Contacts with the distributors of power and of electrical equipment have been maintained, and activities such as cooking schools, group demonstrations, appliance exhibits, and dealer meetings have been carried on to lay a basis of friendly and remunerative working relations.

Close relations with the Rural Electrification Administration have been maintained so that Bonneville's Power Adminstration's program of utilization will be closely coordinated with Rural Electrification Administration's plans. Similar relations have been maintained with other organzations involved in the development of rural electrical usage.

Irrgation and the latest developments in this field have revealed extensive opportunities for power-load development. During the year over

24,000 kilowatts in small sprinkler units (the more recent development in irrigation methods) have been installed to irrigate 16,000 acres of land. The Administration has prepared engineering studies for a number of irrigation districts.

Electric space heating (house heating) as an outlet for power has been another field of intensive inquiry. The public acceptance and demand for this type of heating is much in advance of industry's ability to supply equipment or the power distributors' ability to supply service. Bonneville Power Administration has worked with distributors and manufacturers of heating equipment with a view to meeting the public demand on a basis satisfactory to all.

Pursuing the plan of making accurate and detailed data available to potential industrial customers, the Administration has continued the preparation of its County Surveys—"The Economic Base for Power Markets." Seven new ones have appeared this year, and more are in preparation. Reports on mineral resources and on Pacific Northwest limestone were also completed. Early in 1945 a set of reports on industrial power prospects in the Pacific Northwest was begun for the War Department. These are to be used in a comprehensive report on the Columbia River basin to be submitted to Congress. A number of industrial research projects were conducted in collaboration with the colleges of the region in accordance with the special agreements set up by the Administration with a number of institutions of higher learning in the Pacific Northwest.

Local Distribution

The Administration has established three schedules of resale rates which are set up as standards for the retail distributors who purchase Bonneville-Grand Coulee power at the very favorable Federal wholesale rate. In accordance with the mandate of the Bonneville Act the Administration has cooperated with its customers to have the benefits of the low rates passed on to the citizen-consumers of the region. All contracts with publicly owned utilities bear some agreement toward this end, with the Bonneville standard resale rates generally accepted as an objective toward which the distributor should aim. In the case of the privately owned utilities this problem has still to be solved.

The schedules of resale rates set up by the Administration apply to residential, commercial, and street-lighting customers and set forth in detail the rates, minimum charges, methods of payment, delivery points, metering, and other pertinent matters.

For residential customers the recommended rates are as follows:

First 50 kilowatt-hours per month at 3 cents per kilowatt-hour.
Next 50 kilowatt-hours per month at 2 cents per kilowatt-hour.
Next 200 kilowatt-hours per month at 1 cent per kilowatt-hour.
Next 900 kilowatt-hours per month at ½ cent per kilowatt-hour.
Over 1,200 kilowatt-hours per month at ¾ cent per kilowatt-hour.

For commercial users the rates are as follows:

Energy charge:
- First 150 kilowatt-hours per month at 3 cents per kilowatt-hour.
- Next 350 kilowatt-hours per month at 2 cents per kilowatt-hour.
- Next 1,000 kilowatt-hours per month at 1 cent per kilowatt-hour.
- Next 13,500 kilowatt-hours per month at 0.8 cent per kilowatt-hour.
- Next 50,000 kilowatt-hours per month at 0.5 cent per kilowatt-hour.
- Excess above 65,000 kilowatt-hours per month at 0.3 cent per kilowatt-hour.

Demand charge:
- First 10 kilowatts demand per month, no charge.
- Excess above 10 kilowatts demand per month at 95 cents per kilowatt.

The standard street lighting rate consists of two parts, an energy charge and an investment charge, and applies for a term of not less than 1 year.

Table 8 indicates the energy deliveries to all types of customers by Bonneville Power Administration during fiscal year 1946. Table 9 lists all types of new customers provided with service during 1946.

TABLE 8.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1946*

	Energy deliveries for year	Date of initial service
DELIVERIES UNDER POWER CONTRACTS		
Public owned utilities:		
Municipalities:	*Kilowatt-hours*	
Canby, Oreg	2,227,200.	February 1940.
Cascade Locks, Oreg	1,890,600	March 1939.
Centralia, Wash	176,000	January 1941.
Drain, Oreg	1,036,040	April 1941.
Ellensburg, Wash	5,943,600	May 1941.
Forest Grove, Oreg	7,414,400	December 1939.
Grand Coulee, Wash	4,454,400	January 1942.
McMinnville, Oreg	21,135,000	October 1940.
Milton, Oreg	302,400	June 1946.
Monmouth, Oreg	2,340,800	December 1940.
Total municipalities	46,920,440	
Public utility districts:		
Clark County Public Utility District No. 1		
Air Reduction	3,002,000	August 1942.
City Limits	1,540,129	May 1946.
Dormitory	4,877,875	September 1942.
Harney	7,928,376	January 1946.
Mill Plain	54,230,400	September 1942.
Vancouver Shipyard	1,162,125	May 1946.
Clatskanie Public Utility District	1,611,724	March 1943.
Cowlitz County Public Utility District No. 1	111,397,447	August 1941.
Grant County Public Utility District No. 2		
Soap Lake	1,573,600	August 1942.
Coulee City	657,700	August 1942.
Grays Harbor County Public Utility District No. 1.	70,853,000	November 1940.
Kittitas County Public Utility District No. 1	1,272,300	June 1941.
Klickitat County Public Utility District No. 1.	807,540	November 1940.

TABLE 8.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal yea ending June 30, 1946—Continued*

	Energy deliveries for year	Date of initial service
DELIVERIES UNDER POWER CONTRACTS—continued		
Public owned utilities—Continued		
Public utility districts:	*Kilowatt-hours*	
Lewis County Public Utility District No. 1.		
Mossyrock	3, 268, 800	May 1941.
Elbe	2, 489, 752	October 1945.
Pacific County Public Utility District No. 2.		
Raymond	12, 048, 347	October 1940.
Naselle	7, 241, 400	November 1940.
Dredge	699, 720	April 1946.
Skamania County Public Utility District No. 1:		
Stevenson	3, 285, 600	January 1940.
White Salmon	916, 200	April 1942.
Bonneville Dam	12, 000	January 1943.
Wahkiakum County Public Utility District No. 1:		
Cathlamet	3, 280, 800	November 1940.
Svenson	804, 720	Do.
Total public utility districts	294, 961, 555	
Cooperatives:		
Benton-Lincoln Electric Cooperative:		
Albany	4, 009, 680	October 1940.
Harrisburg	84, 700	May 1946.
Benton Rural Electric Association:		
Prosser	2, 176, 200	July 1942.
Grandview	2, 319, 000	Do.
Big Bend Electric Cooperative:		
Ritzville	1, 650, 400	August 1942.
Delight	351, 104	August 1945.
Blachly-Lane Electric Cooperative	364, 200	September 1945.
Clearwater Valley Light & Power	4, 732, 000	August 1942.
Columbia County Rural Electric Association.	2, 825, 520	July 1941.
Douglas Electric Cooperative:		
Oakland	2, 573, 315	Do.
Brockway Junction	763, 800	September 1941.
Hood River Electric Cooperative	11, 200	May 1946.
Idaho County Light and Power Cooperative	878, 500	August 1942.
Inland Empire Rural Electric Association:		
Colfax	7, 154, 800	Do.
Geiger	68, 950	June 1946.
Opportunity	5, 528, 900	August 1942.
Spring Valley	44, 700	June 1946.
St. Johns	59, 400	Do.
Valley Way	74, 200	Do.
Kootenai County Rural Electric Association:		
Coeur d'Alene	2, 253, 400	August 1942.
Harrison Flats	135, 450	Do.
Lane County Electric Cooperative	180, 420	March 1946.
Lincoln Electric Cooperative		
Davenport	1, 530, 918	April 1942.
Almira	1, 941, 876	Do.
Nehalem Valley Electric Cooperative	417, 360	February 1941.
Nespelem Valley Electric Cooperative	1, 197, 980	September 1941.
Northern Idaho Rural Electric Association	1, 501, 500	May 1943.

TABLE 8.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1946—Continued*

	Energy deliveries for year	Date of initial service
DELIVERIES UNDER POWER CONTRACTS—continued		
Public owned utilities—Continued		
Cooperatives—Continued	*Kilowatt-hours*	
Okanogan County Rural Electric Association.	678, 480	August 1942.
Pend Oreille Electric Cooperative	789, 480	May 1943.
Salem Electric Cooperative		
West	4, 714, 080	March 1941.
North	1, 078, 800	October 1945.
Stevens County Electric Cooperative		
Addy	1, 129, 860	August 1942.
Evans	2, 613, 900	Do.
Umatilla Electric Cooperative		
Substation	2, 169, 798	July 1942.
Depot	3, 246, 354	February 1943.
Wasco Electric Cooperative	1, 233, 300	May 1941.
West Oregon Electric Cooperative	212, 400	December 1945.
Total Cooperatives	62, 695, 925	
Irrigation district:		
Vera irrigation district No. 15	1, 920, 804	Do.
Total publicly-owned utilities	406, 498, 724	
Privatley owned utilities:		
Mountain States Power Co	4, 341, 000	August 1943.
Pacific Power & Light Co	32, 331, 515	June 1941.
Portland General Electric Co	883, 222, 000	December 1939.
Puget Sound Power & Light Co	730, 654, 000	October 1943.
WWP–PP&L–NE Companies	90, 935, 000	
Total privately owned utilities	1, 741, 483, 515	
Military establishments (13)	59, 969, 776	
Industries (21)	3, 232, 384, 635	
Total under power contracts	5, 440, 336, 650	
DELIVERIES UNDER EXCHANGE AGREEMENTS		
Publicly owned utilities:		
Eugene, Oreg	13, 344, 000	
Seattle, Wash	97, 295, 000	
Tacoma, Wash	118, 146, 000	
Total publicly owned utilities	228, 785, 000	
Privately owned utilities:		
California-Oregon Power Co	17, 615, 000	
Mountain States Power Co	2, 000	
Pacific Power & Light Co	19, 623, 485	
Portland General Electric Co	18, 000	
WWP–PP&L Companies	124, 766, 374	
Total privately owned utilities	162, 024, 859	
Total exchange	390, 809, 859	
Total of energy sales under power contracts and exchange	5, 831, 146, 509	

TABLE 9.—*List of customers provided new services by Bonneville Powe Administration during the fiscal year ending June 30, 1946*

Customer	New customer contract demand	Additional point of delivery	From transfer to direct service	Additional capacity
Public or peoples' utility districts:	*Kilowatts*			*Kilowatt*
Clark County, Wash., Public Utility District No. 1.		Harney	Harney to city limits	3,00
Clark County, Wash., Public Utility District No. 1.		Vancouver Shipyards		2,00
Grays Harbor County, Wash., Public Utility District No. 1.				50
Lewis County, Wash., Public Utility District No. 1.		Elbe		50
Pacific County, Wash., Public Utility District No. 2.		Tide Flats		1,00
Cooperatives:				
Benton-Lincoln Electric Cooperative, Inc.		Harrisburg		20
Big Bend Electric Cooperative, Inc.		Delight		10
Blachly-Lane County Cooperative Electric Association.	40			
Douglas Electric Cooperative, Inc.			Oakland to Drain	
Hood River Electric Cooperative.	200			
Inland Empire Rural Electric, Inc.		Geiger [1] Spring Valley [1] St. John [1]	Valley Way [1]	
Lane County Electric Cooperative, Inc.	100			
Salem Electric		North Salem		10
West Oregon Electric Cooperative, Inc.	100			
Municipalities:				
City of Drain, Oreg			Douglas Electric Cooperative to Drain.	
Milton City, Oreg	500			
Irrigation districts: Vera Irrigation district No. 15	500			
Industries:				
General Construction Co	1,500			
Salem Alumina plant	[2] 55,000			

[1] Load at opportunity transferred to these 4 points.
[2] Capacity to be made available by Bonneville Power Administration upon demand.

Bonneville Power Administration Advance Program

The advance program planned by the Administration for the six fiscal years 1947 to 1953 reflects the planning and construction of the transmission system which was deferred because of wartime restrictions, deficiencies in manpower, and shortages of critical material. It also reflects the findings of several comprehensive regional studies being jointly made by the Administration, the Bureau of Reclamation, and the United States Corps of Engineers.

The program is based on an estimated load growth of approximately 285,000 kilowatts per year for the entire service area. Although by December 1945 the firm power peak load of Bonneville Power Administration had dropped to 720,000 kilowatts (approximately 50 percent below the wartime peak) because of the closing of war plants, it was anticipated that the peak load for December 1946 would exceed 1,200,000 kilowatts. The expected peak load forecast for December 1947 exceeds the previous all time peak of January 1945, which was 1,427,000 kilowatts.

The demands of the light metals industry and the demands of other inustries, which are expected to equal each other by 1952, account for a arge portion of the future loads of the Administration. In addition, very significant increases in loads are expected for the wholesale customers who resell Bonneville power to ultimate consumers. These include the privately owned utilities of the region as well as a large number of publicly owned distributors. Contrary to expectations, the loads of the large privately owned utilities continued to increase following the war. These loads will undoubtedly continue to grow, and most of the increased demands of their systems will need to be met by purchases from the Administration since the large utilities are not, on the whole, planning any significant increases in generating facilities. Even greater increase is expected on the systems of the smaller publicly owned distributors, most of which depend on Bonneville Power Administration for power.

Considering the growth in the demands of industrial and utility customers it is forecast that the peak load of the Administration will double between 1947 and 1952, and that it will increase another million kilowatts by 1955.

To meet this demand will require the maximum utilization of the generating facilities of nine additional multipurpose projects scheduled for construction from 1948 to 1953 in Idaho and western Montana, and on the Columbia, Lower Snake and Willamette Rivers. To interconnect the generating plants of these projects with present and developing load centers will require the construction of about 1,500 miles of 230-kilovolt main line transmission grid, and 1,200 miles of 115-kilovolt and lower voltage lines, with the necessary substation capacity. This construction, during the 6-year period, will cost approximately $40 million per year.

The resulting transmission grid will make possible an integrated operation of all electric power facilities in the Northwest. The economies resulting from such integrated operation will, to some extent, offset the rapidly increasing price levels of material and labor and should help maintain the low level of electric power costs upon which the development of the region is dependent.

The advance program also reflects the expressed postwar demand for public ownership of electric distribution facilities throughout the service area. Increased distribution of electricity on a nonprofit basis by public utility districts, municipalities, and cooperatives will mean greater use of power at the lower retail rates. There will thus be greater loads on the Bonneville system. Since public agencies are preferred customers, under the Bonneville Act, their increased demand may, during critical periods, affect the actual dispatching of power according to priority.

Wholesale Power Rates

The basic rate structure for Bonneville-Grand Coulee power is officially designated the C–rate and establishes $17.50 per kilowatt-year as the price of power anywhere on the transmission system beyond 15 miles from the dam. (At the dam, and within 15 miles of it, the rate falls to $14.50 per kilowatt-year.) Several optional rates are available to customers, bu all are consistent with the $17.50 rate level.

A revised set of wholesale rates, including A–4, C–4, E–3, F–3, and H–3 schedules, and General Rate Schedule Provisions, was made effective March 1, 1946. Major changes were made in the E–3 and F–3 schedules in the provisions for irrigation and drainage pumping service, and in the 2.5 mill dump energy H–3 schedule by which the rate is extended to apply to energy delivered for experimental purposes, and the adjustment for power factor is omitted.

The basic kilowatt-year rate has been particularly effective in encouraging growth of industries using electricity at a high load factor and in such quantities as to make power an important item in their costs of manufacture. The postwar industrial development made it advisable to devise several new wholesale power rates which have been filed with the Federal Power Commission for approval.

A new wholesale power rate, schedule R–1, applies primarily to railroad electrification, although it is made available to any type of industry having the load characteristics specified under the rate. Service is supplied at 4 mills per kilowatt-hour and is restricted to loads that coincide favorably both with the availability of power on the Bonneville system and with the system load curve.

Another proposed rate, schedule S–1, covers the sale of secondary energy at the low rate of 1 mill per kilowatt-hour. This rate has been designed to market a limited quantity of byproduct power, to make such power available in the most advantageous manner in the development of the region, and yet to provide a maximum of revenue. It covers energy to be used in industrial processes which can shut down operations for limited periods without serious effect on employment or on the economy of the community, and is restricted to purchasers of firm power or to purchasers who maintain standby facilities which can be used when secondary energy is not available.

A new wholesale power rate provision for irrigation pumping service is to be incorporated in schedule E–3. This establishes a yearly maximum charge of $6 per kilowatt, which includes all charges for service except energy charges for usage prior to May 1 and after September 30. The rate has been fixed as low as possible, recognizing the character of the power to be supplied and all favorable factors, but avoiding subsidy for irrigation. The other special irrigation pumping provisions of existing wholesale rates will remain in effect. The sale of irrigation pumping power is correlated with the sale of space heating power so that the two loads together make use of a block of firm power, the irrigation pumping using it in the summer and the space heating in the winter.

Further studies are being continued on necessary revisions or adaptations of the existing schedules to meet the requirements of industries and various types of loads. Particularly in the forefront are studies of appropriate rate schedule provisions for space heating service.

Important Special Studies

During the past fiscal year the Bonneville Power Administration's Payout Report was completed and presented to Congress. This study showed that the present wholesale rates will fully cover the operation and maintenance expenses of the Administration and those of the Bonneville and Columbia Basin (Grand Coulee) projects allocated to power and that reimbursable construction costs, including replacements, allocated to power will be returned to the Treasury with interest within 50 years from the date such construction costs are incurred.

This was the first time since the inception of the Administration that such a report could be made, for it had to wait on the completion of the study of the allocation of the construction costs of Bonneville and Grand Coulee Dams, and on the first independent commercial-type audit of the accounts of the Administration, both of which were concluded last year. A new independent audit is now being made for fiscal year 1946 and a revision of the payout schedules will follow its completion. Because the audit is still in progress no formal balance sheet for the fiscal year appears with this annual report. Until it is completed a statement will not be available, but as soon as it is possible the Administration will make a separate financial report.

The significance of the payout report has been recognized by the Bonneville Advisory Board which has appointed a special committee to prepare a payout analysis that will include additional Columbia River drainage basin projects in the total picture. Further, the Columbia Basin Inter-Agency Committee has appointed a special committee to analyze the problems involved in the payout analysis and related financial operations and to make recommendations for their solution.

Another important study was the report on the Upper Snake Basin in Idaho, with special reference to the power needs and potentialities, conducted jointly by the Administration and the Bureau of Reclamation. This report, made at the request of the Secretary of the Interior, is just being completed.

Personnel

The personnel of the Administration, including those on leave without pay, on June 30, 1946, totaled 2,173. The Personnel Division was thoroughly reorganized to meet peacetime conversion demands. Training and employment functions were materially strengthened and miscellaneous services involving employee-supervisor relations were consolidated.

Three-fourths of the military furlough employees returned to the Administration and were successfully placed. This is noteworthy since there were at one time over 1,200 employees on military furlough, with an active Administration pay roll of only 1,800. Definite action was begun on the problem of placing disabled veterans.

The labor relations program of the Administration, formally expressed in the Collective Bargaining Agreement signed May 2, 1945, was strengthened and implemented by the passage of House bill 2690 on October 23, 1945. Under amendments to the Bonneville Act contained in this act, wage board procedures were eliminated; and the Administration became the first regular Federal agency to extend the retirement protection of the Social Security Act to all laborers, mechanics and workmen not subject to the Civil Service Retirement Act, and to provide unemployment compensation for all hourly paid employees.

To assure the Administration a permanent nucleus of competent trained workmen skilled in the techniques and procedures required in the operation of the Bonneville-Grand Coulee transmission system, provision was made for a utility crew of permanent hourly employees, kept to a minimum in size and enjoying full civil service, unemployment compensation, and travel expense rights; fluctuations in construction operation are met by hiring temporary construction employees without civil service and travel expense rights. To provide effective utilization of existing skilled personnel, equipment operations of various organizational units were combined in a central equipment pool, the operators being assigned with the machines to field work as required.

Relations with universities and colleges in the Pacific Northwest were reopened, by providing summer employment at the Administration for college juniors and seniors who would become acquainted with the procedures and techniques of the Administration.

Intensified work on employee-supervisor relations was reflected in the complete overhauling of the efficiency-rating program and the revitalizing of programs for employee suggestions and awards for superior accomplishments. Closer tie-in between the day-to-day administrative problems and management needs of the organization was secured through the formation of a management council for top administrative officials.

Employee interest in the work of the Administration was furthered by intensive orientation work and by the appearance of an official informational weekly, "BPA Currents." The Bonneville Associates, an employee welfare organization, won first prize in the noncommercial division at the Portland Rose Festival parade with their float, "Power for Peace."

Although limited by law in the development of a medical program, the Administration secured the cooperation of the Multnomah County Health Department in making official physical examinations of hourly employees, for which the Administrator was permitted, by law, to hire medical services.

Nearly 400 safety meetings were held during the year, and the Administration won the first award of the Portland Safety Traffic Commission in the Government division.

Highlights of Fiscal Year 1946

Return of the war load as a peace load.—Quick return of the war load n a peacetime production basis changed the emphasis from selling a power urplus to finding an adequate power supply for the immediate future and or the next 6 years, and stood out as the Administration's preeminent ighlight of fiscal year 1946. The restoration of this load has many mmediately favorable implications for the region's reconversion and eemployment situation as well as for progress in its industrial development nd diversification.

However, the power supply problem is very pressing, if it is not to amper continuing development and well-being in the Pacific Northwest. The general regional power shortage can be met in time only by construction of more dams in the multiple-purpose river development program, nd of additional transmission lines. Accelerated installation of additional generators at Grand Coulee and wherever else feasible, can help meet the mmediate needs. The power shortage can certainly not properly be met by curtailing power use if development is to proceed and valuable industrial prospects not be lost. The power-supply program and the power-use program, both of which require action some years in advance of actual results, f developed on a parallel basis, will insure no delay or curtailment in the basic development of the region.

Staff-development program.—With the end of the war and of the problems of dislocation in staff personnel the war had inevitably caused, and with the return of employees from war furlough, a thorough staff-development plan has been formulated. This is composed of several programs involving various sections of the staff. It includes 20 sessions of conferences, lectures, and studies for supervisory personnel; an indoctrination course for employees in the field of management and public utility operation; training for student aids, recruited from Pacific Northwest institutions of higher learning for summer apprenticeship at the Administration; enlargement of the training program for apprentices within the agency; tours of familiarization for all employees through all operations of the organization; and systematic dissemination of general information about the Administration and its activities among all employees. Such a coordinated and far-reaching plan will increase the feeling of unity within the organization and heighten the morale, interest, and knowledge of the staff.

Bonneville Regional Advisory Council.—The continued and constructive functioning of the Administration's unique experiment in grass-roots advisory participation is another of the notable high lights of the year. Membership in the council has been somewhat enlarged, and the members, who attend at their own expense, have demonstrated an active and continuing interest in the proceedings. Recommendations of the council have been of invaluable aid to the Administration in carrying out its program.

During the past year the council has particularly considered regional research in relation to the operations of the Bonneville Power Administration and the merits of a broadened and coordinated interagency research program as a medium for aiding the development of the region. The council has placed on record recommendations that (1) an amendment to the Bonneville Act be drafted, for further consideration by the council, which will specifically state the responsibility of the Bonneville Power Administration in the field of research as a power marketing agency; and that (2) a program of coordination of research activities for agencies in the region be developed and presented to the council for consideration.

Bonneville Advisory Board.—During the past 8 years the Administrator has, at intervals, consulted with the Bonneville Advisory Board, established by the Bonneville Act to function in an advisory capacity. As required by the act the Board has been composed of representatives designated by the Secretaries of War, Interior, and Agriculture, and by the Federal Power Commission. Composed largely of busy officials of the national level, the Board has found it difficult, especially during the war, to arrange meetings, which generally had to take place in Washington.

In view of the fact that the Bonneville Power Administration is an exclusively regional agency its Administrator has for some time felt that a Board more intimately concerned with the region could meet more easily and more effectively. Early in 1946 the Secretary of the Interior, therefore, designated a regional official to act for his Department, on the Board, and the other three departments concerned shortly followed suit. The Board is now meeting on a regional quarterly basis.

The most recent meeting of the Bonneville Advisory Board was held at Boise, Idaho, on June 5, 1946. At this meeting a subcommittee was appointed to report on the matter of costs and payout with the object of getting interagency agreement on all financial matters relating to the multiple-purpose projects involving power, in which the various agencies are jointly interested.

Columbia Basin Inter-Agency Committee.—This Committee was formed in the spring of 1946 by the Federal Inter-Agency River Basin Committee for the purpose of coordinating, planning, construction, and administration of the multiple-purpose development programs of the region. Membership coincides with the membership of the Bonneville Advisory Board to facilitate coordination of activities and to avoid duplication of effort, and consists of the following regional officers: War Department—Col. Theron D. Weaver, Division Engineer (Chairman, 1946–47); Interior Department—R. J. Newell, Regional Director, Bureau of Reclamation; Department of Agriculture—George T. Hudson, Office of Secretary; Federal Power Commission—Lesher S. Wing, Regional Engineer; and Bonneville Power Administration—Paul J. Raver, Administrator (who is Chairman of the Bonneville Advisory Board).

The Committee has held monthly meetings and has supplied a much needed vehicle for interagency information and correlation.

Southwestern Power Administration

DOUGLAS G. WRIGHT, *Administrator*

CREATED by order of the Secretary of the Interior on August 31, 1943, the Southwestern Power Administration since has functioned for the purpose of fulfilling the requirements expressed in Executive Orders 9366 and 9373 which provided for unified administrative control during the war of the Grand River Dam project in northeast Oklahoma, and the marketing of power generated by that project, and the additional marketing of power generated by the hydroelectric plants at the Norfork Dam project in north-central Arkansas and the Denison Dam project located on the Texas-Oklahoma border. The Norfork and Denison projects are operated by the United States Army Corps of Engineers, the Administration being concerned solely with marketing the electric energy at wholesale.

During the war approximately 95 percent of the energy produced at the three projects went directly into the war effort. Heavy war loads were sold to the Defense Plant Corporation's aluminum plant at Jones Mills, Ark.; Camp Gruber, near Muskogee, Okla.; the Oklahoma Ordnance Works, near Pryor, Okla.; and the Cardox Corporation at Claremore, Okla.

Revenues derived from the sale of power from the three plants during the fiscal year ended June 30, 1946, totaled $2,254,918.43 despite the fact that the Norfork and Denison projects do not have the advantages of Government transmission line facilities their production being delivered to private companies at the generating plant sites.

Grand River Dam Project

The Grand River Dam project was constructed by the Grand River Dam Authority, an agency of the State of Oklahoma, under a Public Works Administration loan and grant agreement. Construction was started in 1938 and the plant began commercial operation on May 1, 1941. It was taken over on November 21, 1941, by the United States Government from the State of Oklahoma under section 16 of the Federal Power Act, to be completed and operated by the Government to furnish power for the Nation's defense and for the war and was operated by the FWA from that time until September 1, 1943, when it was transferred to the Department of the Interior.

During the 1946 fiscal year gross receipts from power sales amounted to $999,929.53, thus bringing the total revenue for the period since the project has been under Federal control to a grand total of $6,413,082.41.

A bill was introduced and passed during the second session of the Seventy-ninth Congress to return control of the Grand River Dam project to the State of Oklahoma. This project is scheduled to be turned back to the State Authority during the first quarter of the 1947 fiscal year.

During its final year of operating the Grand River project the Federal Government continued to improve and expand the plant's facilities and transmission system. Installation of a fifth 15,000 kilowatt generating unit, ordered in 1941 but held up until 1944 on account of war needs with higher priorities, was continued and the unit should become an integral part of the hydro plant by November 1946.

Improvements to spillways were completed and several contracts were awarded for construction of transmission lines in the northeast Oklahoma area served by the project. One of the most important transmission-line contracts effected was the 110-kilovolt from Okay, Okla., to the site of the Fort Gibson Dam, now under construction in eastern Oklahoma by the Corps of Engineers. This line will serve all construction activities for the new multiple-purpose project.

The proposed contract, attending the return of the project to the control of the State of Oklahoma, provides that the Authority may assume, at its option, any construction which may be in progress. Present plans indicate that construction which will not be completed by November 1, 1946, will be assumed by the Grand River Dam Authority while all other construction will be assumed by the Southwestern Power Administration.

Norfolk Dam Project

The President, under Executive Order 9366, assigned to the Secretary of the Interior the responsibility of marketing the power generated at the Norfolk Dam project in north-central Arkansas.

The Norfolk project is a combined flood-control and hydroelectric development, located on the North Fork of the White River, and constructed and operated by the United States Army Corps of Engineers. The generation plant was built with an initial installation of one 35,000-kilowatt unit with provision for installation of three additional units. The total estimated cost of the project is $26,000,000.

Orders have been placed for the second generating unit and installation should begin early next year.

Since the Government has no adequate transmission system leading out of the Norfolk project, energy generated there since the beginning of commercial operation, March 6, 1945, has gone to nearby private utilities.

Revenue from sale of energy under these circumstances amounted to $496,384.98 during the 1946 fiscal year.

Denison Dam Project

The Denison Dam project, also built and operated by the Corps of Engineers, is located on the main stem of the Red River on the Texas-Oklahoma border near Denison, Tex.

Like the Norfolk project, the Denison project is a combined hydroelectric and flood-control development with an over-all estimated cost of $54,000,000. The initial installation consists of one 35,000 kilowatt generating unit. A second identical unit is on order and will be installed probably during the 1948 fiscal year. When completed the plant will have five 35,000-kilowatt units.

The Denison plant did not go into commercial operation until March 9, 1945, and, like the Arkansas project, delivered its produced energy to private companies at the plant site due to lack of transmission facilities. Gross receipts from power sales during the 1946 fiscal year amounted to $758,603.92.

Postwar Potentialities

The war had moved into its final phases when the Flood Control Act of 1944 assigned to the Secretary of the Interior the duties of marketing the power generated at all multiple purpose dams already built and scheduled for future construction by the War Department. Under the Flood Control Act, Federal agencies, public bodies and cooperatives, and private companies, in that order of preference, were to be served by the Department, and authorization was given for the construction or acquisition of necessary transmission lines and related facilities to accomplish the assignment.

Taking cognizance of the fact that the war years had brought about a strong tendency toward the decentralization of industry and sensing the eventual loss of heavy war-time energy sales, the Administrator of the Southwestern Power Administration made a thorough study, even before the war's close, covering all of the constructed, authorized and proposed War Department projects on the Arkansas, White, Ouachita, Red, Brazos, Neches, and Guadalupe Rivers. This study stemmed from a desire to learn the postwar potentialities of the affected area and determine what benefits might be derived from low cost electric power.

It was evident that the area served by the Administration had prodigious natural resources from which great mineral, industrial and agricultural wealth could be developed rapidly and the detailed study and survey gave graphic evidence that the ultimate goal could be attained more rapidly with the improvement of power distribution.

To fulfill this urgent need for hydroelectric energy, the Administration decided, after further study, that the most efficient method of accomplishing the task at hand was through coordination of the various hydroelectric generating plants already in operation with an over-all plan for adding future plants to the grid upon completion of their construction. The conclusions and recommendations which grew out of these studies were included in a report to the Secretary entitled, "Report of Comprehensive Plan for Power Distribution and Sales from Hydroelectric Projects Authorized by the Flood Control Act, December 1944 (H. R. 4485) in the Southwestern Region—Arkansas, Oklahoma, Texas, Louisiana, southeastern Kansas, southern Missouri."

This report was placed before the Seventy-ninth Congress along with a request for appropriation of funds necessary to carry out the proposed program.

With the two sources from which the Administration was to market electric energy—Norfork and Denison—separated by hundreds of miles, and since it was deemed necessary to coordinate their produced energy, it was proposed that these two projects be brought together electrically through the medium of heavy transmission lines.

To accomplish this end, it was proposed that a heavy 154-kilovolt transmission line be built from the Norfork project to a point near Ola, Ark., where it could be joined with the 154-kilovolt line built during the war by the Ark-La Electric Cooperative for the transmission of electric power from the Grand River Dam project to the Defense Plant Corporation's aluminum plant at Jones Mill, Ark. It was further proposed that the Administration purchase that portion of the Ark-La line which extends from the proposed Ola tie-in to the western terminus of the line at Markham Ferry in northeastern Oklahoma.

From Markham Ferry the proposal requesting construction of a 154-kilovolt line to Tulsa, Okla., and a 132-kilovolt line from the Oklahoma City to the Denison hydroelectric plant.

Marketing Policies

Studies of both available and potential markets for disposition of the electric power have been made and a program of encouraging peacetime industries to locate in the areas which could be served by an efficient and practical power grid has been progressing for 2 years.

The area studied by the Administration was slightly different from that studied by the Federal Power Commission in its survey because of the assignment of particular watersheds to this agency but the results of the Administration's studies checked very closely with the conclusions of the power market survey of the Federal Power Commission.

In the development of the market studies, certain factors that would govern operating policy and consideration of the best use of the projects in question had to be taken into account. They were based on the theory hat the best possible use that could be made of the power generated at he hydroelectric developments was to encourage and foster complete rural lectrification; to furnish power to public bodies owning their own power acilities wherever such action would be of benefit to them; to encourage ew industries and stabilize existing industries; to effect power interchange rrangements; and to furnish peak capacity to existng utility systems and tilize the unused off-peak generating capacity available in their systems to firm up the hydro developments.

Marketing policies to be employed by the Administration will be in strict accordance with the public power policy as set forth by the Congress. However, adequate transmission and distribution facilites must be made available either by utilizing existing facilities or the construction of new facilities to transmit the power from the interconnected hydroelectric developments to the load centers of the area, and to prospective users of the electric service if the most widespread use of the electric power and energy at the lowest possible rate to the consumer is to be secured.

Bureau of Mines

R. R. SAYERS, *Director*

Foreword

THE accelerated depletion of much of this Nation's irreplaceable mineral wealth during the war years and a virtual moratorium on new discoveries impelled the Bureau of Mines to readjust its activities in the fiscal year 1946 to meet another challenge—the development of a peacetime mineral economy effectively integrating technologic advancements made in the war.

Under the stress of wartime necessity, the Bureau had developed certain high-cost processes and techniques for beneficiating low-grade domestic ore reserves. Some of these methods are not adaptable to a peacetime economy, and they are being carefully examined and redesigned to fit in with the increased production of civilian commodities. The Bureau's program of mining research and investigations of domestic mineral deposits has been designed so that it may be expanded rapidly and effectively if necessary to assist in the administration of stock-piling legislation approved by the Congress.

Curtailing somewhat its far-flung search for unexploited mineral deposits in the United States and Alaska, the Bureau last year concentrated upon metals or minerals in which this Nation no longer is self-sufficient or upon those sorely depleted by the demands of war. At Bureau metallurgical laboratories and testing plants, efforts were directed toward the discovery of more efficient methods of breaking down domestic ores and for developing wider uses of known raw materials and new finished products in industry.

On the basis of promising results derived from the examination of more than 200 mineral deposits in 30 States and Alaska last year, Bureau engineers conducted 75 exploratory projects. Some success was reported in marking out added reserves of asbestos, mercury, copper, lead, zinc, iron ores, fluorspar, mica, feldspar, corundum, beryl, spodumene, and bauxite, as well as the ores of tungsten, nickel, and manganese. As a result of Bureau investigations new peacetime mining operations were established in nearly a dozen States for producing asbestos, mercury, lead and zinc, copper, iron, and feldspar. Aided by geophysical surveys, the Bureau marked out a potential magnetite ore body of the order of 375,000,000 tons in Utah that ultimately may become the principal iron-ore reserve for the west coast industries.

In cooperation with mining operators, the Bureau developed new types of mining and drilling equipment and further evaluated the use of diamond drills in blasting and ore-breaking operations. Microseismic methods developed by the Bureau in the removal of pillar ore were supplemented by the development of a photoelastic and resistance strain gage for use in determining underground rock stresses.

Methods for the study of fault patterns in fluorspar areas were set up by the Bureau and assistance was rendered to the Government in grading stock piles of this material which contained some subgrade mineral. To utilize the vast deposits of North Carolina and the Pacific Northwest, the Bureau succeeded in extracting magnesia from olivine, offering a new source of magnesium and its compounds.

Of far-reaching importance to peacetime industries was the production of electrolytic chromium and electrolytic cobalt, as well as the development of processes for producing ductile titanium and zirconium. By producing these four additional highly pure metals, the Bureau supplemented previous well-known metallurgical work that gave industry electrolytic manganese and sponge iron, both of which have been widely accepted as valuable ferroalloy material. In connection with these latter metals, Bureau metallurgists found additional domestic ores suitable for the production of electrolytic manganese and devised additional ways of making sponge iron. With the age of jet-propulsion aircraft emerging from its infancy, pure metals produced under Bureau processes are expected to play an important role in the more rapid development of such craft. The need for metals suitable for high-temperature service, such as jet propulsion and gas turbines, was demonstrated by the Bureau in the operation of a pilot plant at Rolla, Mo., for the reduction of zinc ore with methane gas.

Through its geophysical work, the Bureau supplied Army engineers with information needed in Alaskan engineering projects and for the Alaska military highway. In one of the first surveys of its kind, the Bureau explored the continental shelf by geophysical methods and provided maps and other information to a Senate committee investigating domestic petroleum resources. Anticipating future explorations of these areas, which are believed to contain valuable potential oil, gas, and mineral deposits, the Bureau has outlined a prospecting plan to include extensive underwater surveys. In addition to taking a leading part in the development and testing of new apparatus, the Bureau also has been instrumental in checking new methods, such as magnetic surveys from an airplane, a wartime development of the Navy.

In the face of new problems arising from wartime developments in fuel production and the well-known complexities of fuel shortages which persisted last year, the Bureau's knowledge and long experience in fuel testing rved Government agencies, industry, and the public in wise conservation nd efficient use of fuels and fuel-burning equipment. Technical advice lso was given on types of equipment, fuel-testing and sampling, boiler rrosion, smoke-abatement measures, possible adaptation of foreign equipment to American mining methods, and safe storage of subbituminous coal. t the request of the Department of State, the Bureau furnished information on coal mining and preparation to several Latin-American countries. till seeking new sources of coal suitable for coking, the Bureau determined that Colorado deposits are comparable or superior to the best previously tested western coals, offering a possible source of supply for the estern steel industry. A new outlet was provided for the vast Northwest gnite deposits, which are suitable for reducing iron ores and for producing nany chemicals and some materials needed in the manufacture of synthetic iquid fuels. Bureau fuel technologists detailed to other Government gencies added considerable information on foreign coal preparation and nining methods and hitherto unknown data on the production of synthetic iquid fuels. Extensive tests also were made on new equipment for use in nthracite mines and for bituminous-coal strip mines.

Designed as a wartime agency, the national fuel efficiency program that esulted in the saving of approximately 5 million tons of coal annually durng the last 2 years of the war was concluded by the Bureau.

The lifting of restrictions on civilian use and the industry's desire to replenish war-depleted stocks kept the demand for petroleum and petroleum products near the wartime peak in the first peacetime year and proved a double incentive for the Bureau's efforts to increase the known petroleum reserves through more efficient recovery methods and the perfection of processes for making synthetic liquid fuels. New stimulative methods of oil production were investigated and laboratory research was intensified to produce suitable products from the less desirable crudes. Developing a method for minimizing or controlling equipment corrosion in gas condensate fields, the Bureau also isolated three pure sulfur compounds and offered some hope for converting high-sulfur crudes to more general commercial use.

As a natural sequel to previous work on the wartime production of aviation gasoline, the Bureau determined that crudes from at least 30 of the Nation's largest oil fields are suited for the production of jet-propulsion fuels, thus assuring a steady source of fuel supply when the need arises.

All of the major installations outlined in the Bureau's synthetic liquid fuels program became realities last year with the addition of a new gas-synthesis laboratory at Morgantown, W. Va., and a Government-owned ammonia plant at Louisiana, Mo., which is being converted into a 200-barrel-a-day hydrogenation plant. Construction work progressed on previously authorized units at Bruceton, Pa., for research on hydrogenation and gas synthesis; at Laramie, Wyo., for the development of oil-shale distillation methods; and at Rifle, Colo., for on-the-spot experiments with oil shale from the nearby oil shale mine. Meanwhile, laboratory research and experiment on equipment design coupled with information from foreign sources indicat an encouraging reduction of production costs for the two proposed method for making oil and gasoline from coal, lignite, and oil shale. During th construction of additional facilities, considerable experimental work both o design and processes has been accomplished at Pittsburgh, Pa., where th Bureau first established a small pilot plant many years ago to make syntheti gasoline from pulverized coal.

With the decline in military requirements for helium, the Bureau's production of this lightweight gas was reduced correspondingly last year, although additional sales to private users indicated an increasing peacetim market for the gas. Operating only four of its five plants, the Burea easily met military and non-Federal demands for helium in wartime, producing 434,190,000 cubic feet of the gas in the last 6 fiscal years. As a conservation move to insure future supplies, more than half of the 63,403,34 cubic feet of helium produced in the fiscal year 1946 was returned to th underground storage reservoir established in the Government-owne Cliffside field at Amarillo, Tex. The war-built Cunningham, Kans., plan was closed last year, and the Otis, Kans., plant was placed in temporar stand-by status along with the Shiprock, N. Mex., plant. Helping to develop new peacetime uses for helium, the Bureau conducted an extensive tes in using the gas as a tracer and encouraged wider use of helium in metallurgical work, for medical purposes, and in scientific studies.

The Bureau's health and safety programs, admittedly important in wartime, assumed more impressive significance last year as industry made increasing demands upon the Bureau for more first-aid instruction, expande accident-prevention programs, and technical assistance for the preventio of explosions, roof-fall accidents, and elimination of health hazards in th mining and allied industries. Frequently revised to meet changing requests Bureau standards were applied to coal mining, metal mining, and industrial plants with equal success. More than 19,000 persons were trained b Bureau engineers and safety instructors in first aid last year and about 4,00 received accident-prevention instruction. Bureau safety experts assisted a the 3 major mine disasters and investigated more than 50 other explosions and fires last year. Regulations in force during Government operation o bituminous-coal and anthracite mines added new responsibilities to Federal coal-mine inspectors, who examine more than 2,700 mines. In the course of these inspections, the Bureau analyzed more than 16,000 gas and dust samples and offered many recommendations for the reduction of hazards. Major improvements were effected voluntarily at many mines and continued improvement was reported in the mining industry as a whole. Bureau statistics showed that coal production in World War II was less costly in lives than in World War I. Special attention was devoted to flood prevenion and subsidence problems in the anthracite industry and further tests vere made on the suitability of diesel locomotives for underground mines. ureau laboratories continued the examination of mine equipment and materials for safety and also conducted special investigations on safe equipnent design for use by the Navy. Of outstanding importance was the uccessful demonstration of a new underground communication system in he Bureau's experimental mine at Bruceton, Pa.

In connection with its studies on nonmilitary explosives for use by industry, the Bureau made hundreds of gallery and control tests as well as hemical examinations and brought the number of permissible explosives on its list to 180. Many special investigations were made for the Army and industry, and standards for the safe use of sheathed explosives and iquid-oxygen explosives were set up after exhaustive tests. Research involving the use of hydrogen peroxide as an oxidizing agent and development of equipment for measuring rates of detonation were completed by the Bureau. Technical advice on the disposal or industrial use of surplus military explosives in this country and at foreign bases was given frequently by Bureau personnel to the armed forces. Activities of the Explosives Control Division, which supervised the handling of millions of pounds of nonmilitary explosives during the war, were suspended in December 1945. In the 4 years of the program, the Bureau issued or reissued through volunteer workers more than 800,000 licenses in the 48 States and Alaska.

The retooling of industry to civilian production brought hundreds of new requests to the Bureau for economic and statistical information on minerals and basic facts on domestic and foreign production, stocks, distribution, and consumption. Some of the Bureau's statistical services were revised to incorporate features developed in wartime and a number of surveys conducted by war agencies were added to the Bureau's regular list. As rapidly as possible the Bureau published information previously withheld from general circulation, including foreign data and statistics on certain metals and strategic minerals. The Bureau's extensive files furnished much needed information to Government agencies in the disposal of surplus stocks and in the preliminary steps for stock-pile legislation. Employment figures and facts on the causes and frequency of accidents in the mineral industries were used in a variety of ways by numerous Government and private agencies in the industrial reconversion period.

Since the Bureau of Mines is primarily a technologic agency, an important function is the preparation of scientific reports describing various phases of research and investigation for distribution to the mineral industries and to the public. Last year the demand for technical papers, bulletins, reports of investigations, information circulars, and other publications continued at the usual high level. A considerable backlog of papers withheld during the war was released, and national technical societies called upon Bureau staff members to write numerous papers. The educationa motion picture program of the Bureau experienced an unusually successfu year, nearly 8 million people viewing the films throughout the country. Four new pictures were completed with funds provided by sponsoring industries, and the library had a total of 10,952 reels at the close of the fiscal year. The films are loaned free to schools, colleges, training classes, scientific and engineering societies, and business and civic groups

Summary of Activities

Mineral Development

As an aftermath of the war, the Bureau of Mines paused momentarily in 1945–46 to count the Nation's losses in mineral wealth—virtual exhaustion of mercury, platinum, and antimony; further depletion of its supplies of high-grade coking coal, high-grade iron ores, fluorspar, and copper; dwindling amounts of petroleum, zinc, lead, silver, gold, and high-grade manganese; and almost complete dependence upon foreign sources for nickel, chromite, tin, industrial diamonds, quartz crystals, flake graphite, and long-fiber asbestos.

On the more favorable side, the Nation came out with an overabundance of bituminous coal and lignite, low-grade iron ores, nitrogen, salt, phosphate rock, magnesium, and potash; comfortable supplies of anthracite and natural gas; ample but not profuse amounts of sulfur and molybdenum; and favorable prospects for the development of processes to break down low-grade materials heretofore considered submarginal.

Back on a peacetime basis, the Bureau of Mines concentrated its efforts toward the reestablishment of this Nation's mineral reserves through a broad program of research and investigations utilizing effectively the technologic developments made in the war years. Major research was continued at mining experiment stations at College Park, Md.; Tuscaloosa, Ala.; Norris, Tenn.; Pittsburgh, Pa.; Rolla, Mo.; Minneapolis, Minn.; Salt Lake City, Utah; Boulder City, Nev.; Berkeley, Calif.; Albany, Oreg.; Seattle, Wash.; and a newly established unit at Raleigh, N. C. Important work was conducted at pilot plants or field laboratories at Salisbury, N. C.; Rapid City, S. Dak.; Bauxite, Ark.; Laramie, Wyo.; Pullman, Wash.; and Redding, Calif.

In the fiscal year 1946, Bureau engineers operated on a less extensive scale than in wartime and examined 200 mineral deposits and conducted 75 exploratory projects on deposits in 30 States and Alaska. The value of such explorations has been strengthened by the fact that in many cases diamond drilling and other testing done wholly or in part by the Bureau of Mines have resulted in new firmly established peacetime mining enterprises. Notable among these are asbestos and mercury operations in Alaska; copper mining in Arizona and Vermont; lead-zinc in Idaho, Nevada, Vashington, and Wisconsin; iron in Utah; and fluorspar in Colorado and entucky.

Looking into the future of mineral prospecting in areas inaccessible to round parties, the Bureau of Mines, at the request of the Navy, made a itical examination of the accuracy and value of magnetic surveys from n airplane. In comparing air and ground magnetic surveys conducted in Vorcester County, Md., the Bureau indicated that the air survey method eveloped by the Navy can be improved greatly and made more effective y measuring the vertical magnetic intensity instead of the total magnetic ntensity as practiced at present. In anticipation of more and more uses or geophysical work, the Bureau is prepared to make local and regional nagnetic and electrical surveys and has established facilities for checking ew methods, developing new geophysical techniques, and designing and leveloping new apparatus and equipment.

Pattern of work.—The mining and research investigations of the Bureau of Mines reached a peak during the last 2 years of the war because of the ver-increasing demand for scarce metals and minerals. Mineral investigations were expanded several times in size and in several new directions so lesigned as to be continued should the Bureau of Mines be called upon to ngage in a continuing survey of the Nation's mineral reserves by stock-pile egislation. The Bureau's program as it evolved from the war consisted of 10 types of activity:

1. Examination of mineral deposits that appear from preliminary evidence to warrant investigation from the national viewpoint.
2. Geophysical investigation of promising areas that do not lend themselves to visual examination.
3. Probing and sampling of those deposits that examination and geophysical work indicate warrant it.
4. Analysis of samples obtained.
5. Testing of ores from deposits investigated to determine the most feasible treatment method.
6. Study of labor-saving and money-saving innovations in mining and milling methods.
7. Study of the state of the mineral industry and its future possibilities in individual mining districts.
8. Experimental work on methods of penetrating and sampling.
9. Experimental work on mining methods.
10. Experimental mining, with application of innovations, of parts of typical deposits in order to demonstrate the most effective methods of extracting hitherto unused ores from the ground.

In framing a pattern of mineral production and utilization in peacetime, the Bureau emphasizes the need for full knowledge of methods of mining and treating raw ores, particularly in the case of low-grade deposits that may be needed in time of emergency. During the war the ore-dressing work of the Bureau was directed to especially needed materials that occur in thi country only in very low grade ores, such as beryl, microlite, and spodumene but new reagents and new techniques indicate more efficient recovery i peacetime ore-dressing practice for many common minerals. War experienc demonstrated the necessity for complete pilot-plant study before commercia production starts, and although expensive, the pilot-plant work not onl provides engineering information which permits the erection of commercia plants, but it also provides material which can be used by research institutions everywhere to demonstrate the value of a new and usually better product. In this manner, the Bureau will be able to bridge the gap betwee laboratory studies and commercial production more effectively.

To keep abreast with new developments in mining methods the Bureau' Mount Weather, Va., adit conducted comprehensive tests involving core-drilling rigs of various types, core-drilling equipment, bit coolants, cuttings-removal medium, properties of commercial diamonds, and optimum drillin conditions. Further developing its method for tamping blast holes tha results in a saving of explosives, the Bureau experimented with stemmin and shaped blasting charges.

In cooperation with various mining companies, the Bureau compile and published additional information on the use of diamond drilling fo blasting and ore breaking, particularly effective in a number of iron mine of the Lake Superior district. Several distinct advantages, including a greater safety factor, are cited in the use of diamond drills instead of the usual percussion type of drill.

Based on a process developed by the Bureau, private companies have adopted microseismic methods in the removal of pillar ore from large open stopes at an iron mine in Michigan and at a zinc mine in Tennessee. Another Bureau development—a photoelastic and a resistance strain gage method for studying stresses in mine models—is now in commercial use in connection with investigations of rock stresses in underground mines.

During the fiscal year 1946 some of the restricted reports on wartime mineral exploration and technologic advancements were issued and other publications are in preparation for the aid of the mineral industries and the public.

Iron, steel, and ferro-alloys.—Concentrating on the search for iron ores as well as related materials equally important in the manufacture of steel, the Bureau of Mines in the fiscal year 1946 renewed its efforts to produce high-purity metals and demonstrated several new uses for those already produced. Started before the war, the current work in reality marks a continuation of Bureau metallurgical research, which already has produced two pure metal products now widely known and used in commercial metallurgical processes—sponge iron and electrolytic manganese.

Previous experimental work supplemented by wartime technologic advances has resulted in the production of electrolytic chromium and electrolytic cobalt, as well as the production of ductile titanium and zirconium.

As a result of the Bureau's work and in view of the widespread technical nterest already attracted, commercial production and extensive experiments on possible uses for these materials are anticipated.

Bureau engineers investigated occurrences of iron, tungsten, manganese, nickel, and fluorspar in more than 30 deposits in 17 States and Alaska during the fiscal year. Diamond drilling, trenching or tunneling work resulted in several successful projects warranting exploration of additional deposits. Iron-ore reserves, workable at some future time, were indicated in Alabama, Montana, and Washington, and a major deposit of tungsten of minable grade was outlined in Nevada.

Magnetic surveys were made for magnetite deposits in the Adirondack district at the Dannemora and Russia Station areas, in the Cranberry area of Avery County, N. C., and in Carter County, Tenn. In these latter 2 areas as many as 11 distinct ore bodies of minable size were indicated, most of which had no surface exposure or outcrops. Because of these newly discovered potential iron possibilities, this area may again come into production. The largest magnetite deposits discovered in the fiscal year 1946 have been in Iron County, Utah, around Iron Mountain, Granite Mountain, and the Three Peaks. The potential ore possibilities in this area have been estimated at approximately 375,000,000 tons and give promise of becoming the main iron-ore reserves for the war-built west coast steel industries.

High-purity ferro-alloy metals which only the Bureau has been able to produce in any substantial quantity have been in increasing demand in connection with experimental work being carried forward for the development of high-temperature alloys used in gas turbines and jet propulsion engines.

The Bureau pilot plant at Boulder City, Nev., making electrolytic manganese, distributed many tons of this material to the steel industry for cooperative investigations that resulted in the production of steels superior to or equally as good as those made with ferromanganese. Several additional domestic ore reserves proved amenable to the production of high-purity manganese under the Bureau's electrolytic process.

Expanding its electrolytic work, the Boulder City plant also produced electrolytic chromium from low-grade chrome ores of Montana and electrolytic cobalt from cobalt ores of Idaho. Details of these processes as well as methods for the production of ductile titanium and zirconium were released for the first time during the fiscal year 1946.

Electrolytic chromium, like electrolytic manganese, has yielded many valuable new alloys and its wide use in stainless steels and other chromium steels is freely predicted for the future. Electrolytic chromium is expected to eliminate some of the defects produced by the use of the present ferrochromium, which contains some impurities. The process for using Montana chrome ores has completed the pilot-plant stage and is believed to be ready for commercial application.

In contrast to the hardness and brittleness of titanium, as it has been generally available, the pure metal produced by the Bureau is nearly as ductile as copper and can be rolled into thin sheets and drawn into fine wire. A light metal having only half the density of steel, titanium nevertheless is as strong as mild steel and as corrosion-resistant as stainless steel, suggesting its use in hundreds of ways both in the pure state and as an alloy.

Closely related to titanium, the silvery white zirconium has found commercial use in chemical engineering equipment and in important alloys. Substantial quantities of the pure zirconium, which is the basis of zircon, sometimes used as a gem, have been produced at the Northwest Electrodevelopment Laboratory of the Bureau at Albany, Oreg.

In the hands of the metallurgist, cobalt is one of the most useful of metals and there is hardly an alloy that is not improved by the addition of cobalt. Because of its cost and the necessity of producing it from foreign ores, cobalt has not been used extensively in this country, but the Bureau's process for separating high-purity cobalt from the arsenical ores of Idaho promises to expand domestic use of the metal.

Although the Bureau many years ago firmly established the value of sponge iron in industry, pilot-plant tests at Laramie, Wyo., Minneapolis, Minn., and Salisbury, N. C., have demonstrated the possibilities of producing high-grade sponge iron in a variety of ways. The pilot plant at Redding, Calif., proved that high-grade steels can be produced effectively by using sponge iron and the electrolytic ferro-alloy metals. Further progress was made at the Northwest Electrodevelopment Laboratory at Albany, Oreg., in breaking down the complex nickel- and chromium-containing iron ores in Washington for the production of nickel-iron and nickel-iron-chromium alloys.

The development by the Bureau of a technique for determining fault patterns and locating the faults controlling mineralization has brought increased importance to the fluorspar areas of Crittenden County, Ky. Large mining operators are increasing their activity with the Bureau's help in the mineral development of the area.

Nonferrous minerals.—From a position of comparative self-sufficiency before the war in some of the nonferrous minerals—chiefly copper, zinc, and lead—the United States today is faced with greater dependence upon foreign sources for these materials and many others unless future discoveries or improved technology increases our known remaining supply. Conservative estimates place the domestic commercial reserves of mercury, cadmium, bauxite, vanadium, tungsten, platinum, mica, and antimony at less than a 10-year supply.

Some encouraging results were obtained from Bureau of Mines projects conducted in 15 States and Alaska during the fiscal year 1946. In the examination of 28 zinc and lead deposits and 5 copper deposits, Bureau engineers marked out important reserves of lead and zinc in Colorado, Idaho, Kansas, Oklahoma, Washington, and Wisconsin; and equally promising deposits of copper were delineated in Arizona, Nevada, and Alaska. The Bureau examined 90 additional deposits of nonferrous minerals, but these projects were not developed.

Paralleling other experiments on the use of high-purity metals, the Bureau published additional information on research at the Salt Lake City, Utah, laboratory designed to establish the value of electrolytic manganese as a nonferrous metal. Likewise, the production of ductile titanium advanced to the pilot-plant stage, and extensive studies were made of both methods of production and the properties of the finished metal. This work was carried on both at Salt Lake City and at the Bureau's Boulder City, Nev., plant. Commercial production of ductile zirconium at a reasonable cost is anticipated as a result of the development of new techniques at the Albany, Oreg., laboratory.

Supplementing drilling, trenching, or tunneling with geophysical work, Bureau engineers prospected for copper reserves in the Elizabeth Mine copper area in Orange County, Vt.; in the Twin Buttes district of Pima County, Ariz.; and in the Mountain City area in Elko County, Nev. The same methods were applied in the search for zinc in the West Plains area of Missouri, as well as in the Copper Flats district of Grant County, N. Mex. Because most of the minerals used in the war had depleted the reserves of well-established mining operations, the Bureau made efforts to reestablish such well-known reserves. In this connection, surveys for lead were made in the Fredericktown lead area of Madison County, Mo., where buried hills of granite and related intrusives were indicated. Because lead deposition in this area is directly related to alterations in bedding and fractured zones, Bureau pilot research promises future results in this district.

Although some encouraging results were obtained in the operation of a pilot plant at Rolla, Mo., for the reduction of zinc ores with methane gas, the commercial success of this process depends largely upon the development of materials better suited for high-temperature service. The use of some of the high-purity metals already developed and now in production by the Bureau has been suggested for this purpose.

During the fiscal year, the gold and silver work of the Bureau which had been dropped during the war was resumed and greater efforts will be expended to bring about increased production of these metals. For almost a century the United States has been one of the world's leading producers of gold and silver, but the wartime inactivity and the decline in known commercial reserves may endanger this Nation's position in the production of these important metals.

Nonmetallic minerals.—Censorship rules preclude the revelation of complete details, but it now can be told that the Bureau of Mines had a small but important part in solving one of the many problems in the wartime work at the Oak Ridge, Tenn., project where the atomic bomb was perfected.

In addition to serving as a trouble-shooter, the Bureau's laboratory at Norris, Tenn., adjacent to the Oak Ridge plant, aided in developing ceramic porcelain insulators subject to heat shock needed in constructing certain important apparatus.

By diamond drilling and trenching in 5 States and Alaska, the Bureau developed 7 deposits of mica, feldspar, asbestos, corundum, or sillimanite and examined 60 additional deposits of nonmetallic minerals in various States. However, none of the seven projects developed produced encouraging results.

Of great interest to the building industries on the Pacific coast was the development of a process to utilize perlite, a siliceous lava containing magmatic water, for concrete aggregate and for thermal and sound insulation. When heated quickly, this material, long considered of little commercial value, is bloated into porous lightweight grains that serve the same purpose as bloating clays used in eastern building trades.

Further tests on sillimanite of South Carolina-Georgia have proved the value of this material for superduty refractory brick meeting both Navy and A. S. T. M. specifications. The most plentiful supply of the more prismatic form best adapted for this work is found in the Georgia section of the huge volume of material in a schistose zone 150 miles long.

To assist the Government in discarding subgrade mineral in stock piles of fluorspar the Bureau developed a process for eliminating unwanted materials, and the method has been adopted by a number of contractors. On the basis of a Bureau process perfected several years ago for separating feldspar from quartz and mica, several new mills are in prospect and the Bureau has extended assistance to potential operators. Some progress has been reported in a study of flake mica concentration in the Black Hills field office.

Light metals.—With the decline in demands for the principal light metals—aluminum and magnesium—the Bureau of Mines suspended virtually all of its exploratory work in this field during the fiscal year 1946, but continued the operation of a pilot mill at Bauxite, Ark., for the concentration of low-grade bauxites. Even with the decreased market for aluminum for industrial purposes, the Bureau has maintained its extensive metallurgical investigations for the production of alumina from domestic sources. Some of these investigations were continued in cooperation with semicommercial plants established by the Defense Plant Corporation. Results derived from wartime work would seem to justify the continuation of pilot-plant activities and the small-scale production of alumina from domestic ores so that techniques can be continuously perfected and a plant or plants made available for expansion should another emergency arise.

Among Bureau reports on light metals withheld during the war and issued last year were two describing the development of processes to salvage aluminum and magnesium from waste material such as pattern trimmings, cuttings, aluminum dross, and fine magnesium dusts and skimmings and leavings of melting and refinery pots. In wartime, American plants monthly were discarding some 2,900 tons of aluminum containing about 9 percent recoverable metallic aluminum plus considerable aluminum oxide. Scrap or wasted material in wartime plants where magnesium was used in airplanes and in the manufacture of incendiaries and pyrotechnics in some instances amounted to about 35 percent of the weight of the finished products. Through Bureau-developed processes thousands of pounds of aluminum and magnesium ordinarily lost in processing were diverted back into war production.

Coincident with the Bureau's production of ductile titanium and zirconium has been the development of a possible peacetime outlet for additional supplies of magnesium. In the Bureau process for producing these highly pure metals at Albany, Oreg., magnesium is employed as the reducing agent. To supplement the Nation's reserves of magnesium, the Bureau has made progress in extracting magnesia from the mineral olivine. Tremendous deposits of olivine occur in North Carolina and the Pacific Northwest, providing a possible source of almost unlimited extent for magnesium and its compounds.

Geophysical explorations.—Definitely established in wartime as a valuable adjunct in mineral exploratory work, geophysical surveys using both magnetic and electrical methods are expected to serve an even greater purpose in future prospecting for minerals. Geophysical work in the war was not restricted exclusively to mineral explorations but also found application in war emergency projects related to the construction of air fields, buildings, and roads in Alaska. By the use of electrical methods it was possible to measure the depth to the top and bottom of permafrost, information which was required for certain engineering projects including the noted Alaska highway.

Throughout the war, geophysical methods were applied in the search for strategic and critical war minerals including copper, zinc, manganese, iron ores and magnetites, lead, and fluorspar. In addition, these techniques were employed in the quest for additional oil reserves. A magnetic survey of the Florida Peninsula outlined regions generally favorable for oil deposition and similar information was obtained in a survey of Washington County, Ala.

Probably the greatest contribution of geophysical work in the fiscal year 1946 was the exploration of the continental shelf bordering the United States and Alaska, since claimed by Presidential proclamation to a depth of 600 feet as United States territory. This area, approximately 750,000 square miles, contains oil, gas, and mineral deposits of a large potential economic value. With a considerable degree of certainty, preliminary Bureau studies indicate that there is a large potential oil reserve in the continental shelf in the Gulf of Mexico and that there also is a probable large potential reserve of oil on the Arctic coast and the western coast of the United States. A large number of maps showing areas of the continental shelf were prepared by the Bureau for hearings before the Senate Special Committee for Investigating Petroleum Resources.

Since the exploration of the continental shelf up to the present time has been made possible solely by geophysical methods, the Bureau has prepared a careful plan embracing an organization particularly suited to underwater exploration for systematically surveying the entire area. Although private companies have done considerable work in off-shore exploration, little has been accomplished to establish methods for expanding the national petroleum reserves through the location of oil in unprospected areas of the continental shelf, as a part of its exploratory program, the Bureau of Mines is prepared to further such work.

Coal and Coal Product

Returning to peacetime research and technologic work on coal and economy and efficiency in governmental, industrial, and domestic fuel-using operations, the Bureau of Mines redesigned some of its programs to develop substitutes for overcoming the depletion of high-grade coal reserves and to solve new problems evolving from the wartime application of science in the production of different forms of fuel. A cooperative research program conducted by the Bureau and aimed to utilize the extensive lignite deposits of the Northwest demonstrated that both lignite and subbituminous coal can be used for beneficiating iron ores as well as for the commercial production of hydrogen or for the manufacture of synthetic liquid fuels and a wide variety of chemicals.

In maintaining its well-established fuel-testing and boiler-efficiency services, the Bureau of Mines continued to advise Government and industrial fuel users in the purchase and utilization of fuels and fuel-burning equipment, effecting substantial savings both in coal and in equipment costs. In providing such services, the Bureau tested more than 15,000 samples as a part of its safety program for the reduction of dust explosions, in connection with Government purchase and tipple and breaker inspections, and in the examination of coal and related materials in research work. An outstanding service was rendered by the Bureau in the determination of types of fuel and fuel-burning equipment for 37 new hospitals for the Veterans' Administration. With automatic stoking equipment returning to civilian production, new interest was evidenced in smoke abatement and the Bureau offered its services to several cities mapping smoke-curtailing programs.

To obtain the latest information unavailable during the war on European practice in the mining, preparation, and utilization of coal, five outstanding engineers of the Bureau were detailed to the Foreign Economic Administration to serve under the Technical Industrial Intelligence Committee and another was detailed to secure information in Japan on low-temperature carbonization of coal. Records of hundreds of patents and documents were microfilmed and it is expected that the best developments uncovered in these surveys will be tested in the United States.

The conclusion of hostilities brought to an end the national fuel efficiency program, which had enlisted the aid of thousands of volunteer engineers and fuel users to conserve fuels and utilize equipment fully. Cooperating in the 2-year program were more than 16,000 individuals and the estimated savings reached the rate of 5 million tons of coal annually valued at some $30,000,000 per year.

Coal mining and exploration.—Seeking more efficient methods for mining the remaining reserves of anthracite, the Bureau of Mines arranged for the testing of a new-type scraper-shaker-gangway loading machine and special shearing machines for use in mining the thin, steeply pitching beds of anthracite. Light earth-moving equipment for use in strip-mining bituminous coal was investigated and arrangements were made to study a unique coal planer found to be highly efficient in some underground mines of Europe. Extending its coal exploration work, the Bureau proved a deposit of 5 million tons of lignite in Washington minable at low cost by strip-mining methods. In the search for coking coal critically needed for long-term, economically competitive operation of the western steel industry, Colorado deposits tested indicated coal equal to the best previously known western coking coal. Exploration also was conducted in Alaska for coal necessary for regional use, in Alabama for coking coal, and in Maryland for highly desirable semismokeless coal of coking quality. More than 1,800 feet of drill cores from coal beds at seven exploration projects were examined and nearly 1,000 feet of coal from drilling were given detailed tests.

Gas- and dust-explosion research.—For the first time, Bureau of Mines research has made it possible to establish conditions for eliminating explosions in medium-pressure acetylene generators by adding prescribed amounts of hydrocarbons such as natural gas, propane, or butane to acetylene as it is produced in the generator. In extending the examination of industrial powders, dust, and vapor-air mixtures, the Bureau investigated minimum ignition temperatures and minimum spark energies for ignition, limits of inflammability, the use of helium or freon in explosion prevention, and prevention of gasoline and naphthalene explosions and aided in the scientific design of efficient burners.

Coal preparation and storage.—In the search for a low-ash, washed coal for the production of synthetic liquid fuels by the hydrogenation process, the Bureau of Mines examined coal seams in 11 States. The Bureau proved that some strip coal in Washington State, hitherto unmined, could be made marketable by washing. Investigations were made of thinner seams of coal in Maryland and Alabama, information on preparatory coal treatment was furnished to Alaska and several South American countries, a new process, developed in Holland, for cleaning fine coal was investigated, and recoverable montan wax, previously imported, was found in lignite from Malvern, Ark., and Ione, Calif. Based on 4 years of study involving the use of 30,000 tons of coal, the Bureau proved that by using simple methods to prevent air circulation, subbituminous coal can be stored without danger of spontaneous heating and with little loss in heating value.

Coal combustion.—Continuing its research to prevent or minimize corrosion of boiler tubes, the Bureau of Mines developed a procedure for evaluating various protective tube coatings. To secure more efficient boiler design and increase the operating efficiency, the Bureau investigated heat absorption in large central-station boiler furnaces where work also was continued on testing coal-ash slag. Coal-ash slag tests proved useful in studying Rhode Island anthracite used in a slagging gas-producer designed to make rock wool as well as gas. The Bureau developed a test procedure to evaluate fuels from new processes and packaged fuels from various sources.

Coking and gasification studies.—Because war demands and the peacetime reconversion had depleted the supply of the Nation's best-known coking coals, the Bureau of Mines intensified its survey of carbonizing properties of American and some foreign coals with particular emphasis on the search for coals adapted to the making of metallurgical coke. Coking and byproduct tests on three coals from Colorado and four from West Virginia indicated that coal from the Beckley bed of West Virginia might be suitable for blending with high-volatile coal in coking mixtures. Similar coking and byproduct tests were made on several South American coals for the Department of State. In studies on the use of lignite, the Bureau showed that gas suitable for the reduction of iron ores or manufacture of gas for the synthesis of liquid fuels could be made in externally heated alloy retorts.

Synthetic liquid fuels.—Contrary to expectations, this country's peacetime demand for petroleum and petroleum products remained at about the same level as the peak reached during the war, further emphasizing the importance of the Bureau of Mines program for producing synthetic liquid fuels from coal, oil shale, and other substances. As in wartime, the discoveries of oil in new fields during the reconversion period still fell far short of the annual needs of the Nation, indicating that the Bureau's synthetic fuel work will assume an even more vital role as the country's industrial activity increases.

The four major installations required in the Bureau's program under the Synthetic Liquid Fuels Act (Public Law 290) are now under construction and the preliminary progress in the entire program indicates that the United States is well on the way toward the development of processes of commercial applicability for producing oil and gasoline from the country's tremendous reserves of coal and oil shale.

Two processes are being studied at Pittsburgh, Pa., and nearby Bruceton, Pa., and at Morgantown, W. Va., on the research and development scale for the production of oil and gasoline from coal. Equipment now in operation provides for producing and testing catalysts, preparation of coal, gases, and other raw materials from the processes and the operation of two complete units of equipment for the continuous synthesis of oil and gasoline from coal. Other synthesis units, producing up to about a barrel of oil a day, await laboratory space in new buildings under construction.

Breaking through one of the bottlenecks in the design and construction of large-size units of commercial equipment in the preparation of catalysts and in the removal of the heat of reaction, the Bureau made improvements that are expected to cut in half the production costs of one of the processes with prospects for substantial reduction in costs in the second process for making oil from coal.

Material savings in construction costs were effected by the acquisition of the Government-owned wartime synthetic ammonia plant at Louisiana, Mo., which will be converted to a demonstration plant to produce 200 barrels of oil daily by the hydrogenation of coal.

Laboratory development work on the production of oil from oil shale is being conducted in the petroleum and oil-shale experiment station at the University of Wyoming, Laramie, Wyo., and a demonstration plant for oil-shale work is being constructed on reserves held by the Navy near Rifle, Colo. This plant ultimately will produce about 500 barrels of oil per day, but is expected to start operation on a 50-barrel-per-day scale late in 1946.

Preliminary studies have indicated that oil in the United States Naval Oil Shale Reserves is equivalent to about three-fourths of the known petroleum reserves in the entire country. Because of many complex problems involved in refining oil from shale, the Bureau has concentrated on the determination and measurement of those properties of the shale that affect or control the conditions under which the oil should be removed. Completion of this work will make possible the designing of retorts for American oil shale on the basis of sound chemical and engineering data.

Petroleum and Natural Gas

Evolving from the war experiences and prewar work of the Bureau of Mines has been a threefold postwar program of conservation and better utilization of all the Nation's oil and gas resources by a comprehensive program of analysis and testing plus fundamental research into the properties of petroleum hydrocarbons. The broad objectives are designed to increase the primary recovery of oil through more efficient use of the natural energy in the deposits; to stimulate the recovery of oil from old fields by improved methods and increased operating efficiency; and to increase the utilization of marginal oils such as those of high sulfur content.

In 1946 the Bureau completed the last of a group of engineering studies for the Petroleum Administration for War on two important gas-condensate fields in Texas and issued several engineering reports previously restricted.

Additional field work was carried out in the Carthage field in Panola County, Tex., and engineering surveys were started in three new fields, including the important Rangley field in Colorado. Although somewhat curtailed, the Bureau continued the collection and examination of subsurface oil samples and the determination of bottom-hole pressures and temperatures in important new fields.

In cooperation with the Natural Gasoline Association of America, the Bureau investigated internal corrosion of production equipment in gas-condensate fields and, with an inhibitor developed by Bureau engineers, produced satisfactory control of corrosion in test wells in the Opelika field, Texas, and the Cotton Valley field, Louisiana.

Adding to information on stimulative methods of oil production and secondary recovery, the Bureau in 1946 published reports on operations in Illinois and Indiana and completed two reports on fields in Texas and Oklahoma. To help increase the recoverable reserves of the Nation, the Bureau investigated the plugging of the oil-producing formation around wells by the crystallization and deposition of salt and the bypassing of gas or water injected into the oil deposit in secondary recovery operations. In the Appalachian region Bureau engineers continued the development and application of a method of flowing small stripper wells instead of pumping them, thereby reducing operating costs and increasing recovery.

Because of the exceptional drain made upon oil reserves during the war, the Bureau's investigation of methods for economically recovering oil from large surface and near-surface oil-impregnated deposits assumed new importance and encouraging results were obtained in laboratory work in extracting oil from the Edna deposit of San Luis Obispo County, Calif. As a result of pilot-plant work, the Bureau proved the practicability of recovering microcrystalline wax distillate from tank-bottom settlings.

Shifting some of its research work on aviation fuels to the availability and quantity of crude oils of the United States suitable for producing fuels for jet-propulsion aircraft, the Bureau discovered that crude oils from 30 of the largest fields in the Nation were possible sources of jet-propulsion fuels.

For maximum utilization of all grades of petroleum, the Bureau intensified research involving superfractionation, desulfurization, silica gel absorption, hydrocarbon analysis, and engine testing of fuels. Three pure sulfur compounds, pentanethiol, thiophene, and ethyl sulfide, were prepared in the study of sulfur compounds and their effects in petroleum and petroleum products. These and other subsequently purified compounds will be made available to the petroleum industry through the Bureau of Standards. Precise thermodynamic constants were determined on 15 hydrocarbons and tetra-ethyl lead and plans were made to correlate the compositions of diesel fuels.

Helium

All-time helium production records were set repeatedly during the war as Bureau of Mines plants turned out an ever-increasing volume of this valuable lightweight, noninflammable gas for war purposes and for industrial and medical uses. Victory over Japan permitted the first release of statistics since Pearl Harbor and the output in the 6 fiscal years ended June 30, 1946, amounted to 434,190,000 cubic feet of helium. The peak production of 137,268,000 cubic feet was reported in fiscal year 1944.

In 1946, the Amarillo and Exell, Tex., helium plants produced 63,403,345 cubic feet of helium and of this total 203,500 cubic feet was used in experimental work and 32,143,045 cubic feet was injected into the underground storage reservoir of the Government-owned Cliffside gas field of Texas to conserve this Nation's helium reserves.

Reflecting increased private use of helium, the Bureau in 1946 set a new record in the sale of 4,249,125 cubic feet of helium to non-Federal users for industrial, scientific, and medical uses. To offset the decline in military requirements for the gas, the Bureau expanded its research program to discover new uses for helium and demonstrated its unusual value as a tracer in studying oil and gas reservoir conditions in the Elk Hills field, Naval Petroleum Reserve No. 1, in Kern County, Calif.

The defeat of Germany and improved conditions in the Pacific early in the fiscal year permitted curtailment of some of the Bureau's production program; the Cunningham, Kans., plant, built wholly as a wartime expedient, was closed, and the Otis, Kans., plant was placed in stand-by condition along with the Navajo plant at Shiprock, N. Mex., which had been placed in stand-by status in March 1944.

Explosives Research

To safeguard life and property in the handling, storage, and use of explosives and inflammable substances, the Bureau of Mines set up safety standards based on accurate determination of hazards of static electricity and made many special investigations for industry and the armed forces. Testing more than 3,200 new permissible explosives and new types of industrial explosives utilizing surplus military stores, the Bureau added two new explosives to the permissible list which now includes 180.

To establish the limitations and conditions under which sheathed explosives may be used, the Bureau studied the hazards of toxic gases from these explosives and also made industrial tests on the performance and hazards of liquid-oxygen explosives. A study of the ignition of firedamp by explosives disclosed that the position of the detonator relative to the explosive charge plays an important part in the ignition process.

Special inquiries from industry and Government agencies resulted in work on the use of hydrogen peroxide as an oxidizing agent in explosives, in the evaluation of hazards in specific industrial operations, and in devising a method for precisely measuring rates of detonation.

Further tests on the safe use of larger explosive charges at the Bureau's experimental coal mine have confirmed the desirability of continuing the 3-pound explosive charge limit for coal mining instead of the previous 1½-pound limit. Many special studies were continued in cooperation with the Army and the Navy and a member of the Bureau served on the Ordnance Department's Scientific Advisory Committee on Ballistics.

Safety and Health Activities

Released from the pressure of war production, the mineral industries gave more attention to industrial safety during the fiscal year 1946 as the Bureau of Mines again cooperated in offering multifold services in the advancement of health and safety activities.

Revival of interest in first-aid training programs and accident-prevention classes brought increased demands from industry for Bureau personnel in the promotion of safety education, accident investigations, material and electrical testing work, coal-mine inspections and reports, assistance at mine explosions and fires, and field and laboratory studies on the occurrence of gases, dust, temperatures, and other conditions affecting the health of mine workers.

To help solve serious problems resulting from mining in the anthracite region where the industry is financially unable to deal with them effectively, the Anthracite Flood-Prevention Section was transferred from the Fuels and Explosives Branch to the Health and Safety Branch at the beginning of the fiscal year and some progress has been made in aiding anthracite operators.

While the influence of the Bureau's many health and safety programs cannot be calculated precisely, it is acknowledged by the mineral industries that during the fiscal year 1946 scores of lives were saved and the damage of millions of dollars worth of property was prevented. These services would have cost the industry an estimated $1,500,000 had such services been obtainable from private sources.

The safety, educational, and investigative work of the Bureau for more than 3 decades has constituted a valuable service to the mineral industries and could not be replaced by any means except by a similar national organization. Even with its already wide range in this field, the Bureau has been unable to respond to all of the requests from industry because of the lack of personnel. Expansion of the Bureau's first-aid training activities is of greatest importance for continued success and the many requests from organizations and industry concerning explosions indicate the need for more intensive research on the explosibility of gases and vapors. Demonstrations of various types of explosions of these materials were given in several States last year.

The Bureau's broad health and safety program is conducted in the field chiefly by the supervising engineers of the eight districts into which the country has been divided. In addition, there are eight subdistrict or field offices reporting directly to the district offices at Pittsburgh, Pa., Wilkes-Barre, Pa., Mount Hope, W. Va., Birmingham, Ala., Vincennes, Ind., Duluth, Minn., Dallas, Tex., and Salt Lake City, Utah. An important function of the supervising engineers is to correlate the entire program to operate efficiently and without duplication of work.

Although the Bureau of Mines coal-mine inspectors have no enforcement powers to insure the adoption of safety measures in coal mines under the Federal Coal Mine Inspection Act of May 7, 1941, the agreement of May 29, 1946, between the Secretary of the Interior and the president of the United Mine Workers of America, covering bituminous-coal and lignite mines during the period of Government possession, makes mandatory compliance with Federal recommendations based on the Federal Mine Safety Code, promulgated July 29, 1946. Furthermore, the Anthracite Wage Agreement of June 7, 1946, between the United Mine Workers of America and the Anthracite Operators provides that the "Operators and Mine Workers agree to accept such standards of safety adoptable and practical to the anthracite industry." These agreements placed an added responsibility on the Federal coal-mine inspectors and further emphasized the importance of their work.

Mineral-production security programs, including antisabotage work, were suspended at the beginning of the fiscal year and the Explosives Control Division, also a war agency that maintained close surveillance over nonmilitary explosives used by American industries, was discontinued in December 1945.

Safety work.—Responding to industry's demand for expansion of safety programs initiated and stressed in wartime because of manpower and equipment shortages, the Bureau of Mines with its experienced safety engineers and instructors was responsible for first-aid training and mine-rescue instruction, recovery work at mine fires and explosions, investigations of mine accidents, testing and approval of safe mine equipment, research on new methods of underground communication, promotion of accident-prevention work, prevention of flood hazards in anthracite mines, and numerous special field and laboratory studies and services on safety in the mineral industries. Coincidental to the over-all safety program was the preparation and revision of coal-mine inspection standards, organizing and conducting of various courses of instruction, planning of publications on matters pertaining to mine safety, and staging of educational activities by means of motion pictures, lantern slides, and demonstrations.

During the year the Bureau instructed more than 19,000 employees of the mineral and allied industries in first-aid and mine-rescue work, increasing to approximately 1,625,000 the number of persons trained in these activities since the Bureau was established in 1910. Bureau personnel rendered assistance at 16 first-aid and mine-rescue contests in various States last year. Providentially, only 3 major disasters—those in which 5 or more men were killed—occurred during the fiscal year 1946, but experienced Bureau safety workers were on hand to provide expert advice and aid in the arduous and dangerous rescue and recovery operations at these disasters as well as in the investigation of more than 50 other explosions and mine fires and some 70 miscellaneous accidents. In many instances, through the Bureau's efforts mining operations were returned to production with a minimum of delay.

In spite of limited personnel, the Bureau trained approximately 2,000 workers and officials in both coal- and noncoal-mining operations in accident-prevention and also instructed about the same number of employees in sections of the course considered applicable to their positions. Embracing both metal and other noncoal activities as well as the bituminous-coal-lignite-, and anthracite-mining industries, these accident-prevention courses were sought frequently during the fiscal year and procedures were kept up-to-date by engineers versed in coal and noncoal work.

Because falls of roof are responsible for more than half of the fatal accidents in all mining operations, the Bureau in its safety courses has stressed the prevention of roof fall accidents by adequate timbering or shoring methods, or prompt and safe removal of hazardous roof. Reflecting some progress in this work, Bureau statistics show that the accident rate from roof falls in coal mines is declining slowly, but in the metal-mining industry the rate appears to be essentially at a standstill. Although handicapped by limited funds and personnel, the Bureau will continue to place emphasis on this phase of instruction.

With the resumption of activities of the Joseph A. Holmes Safety Association, suspended during the war, Bureau personnel took part in the presentation of numerous safety awards to plants, supervisors and other individuals in all branches of the mining industry for outstanding achievements in safety. Maintaining contact with existent local chapters and district councils of the Holmes Safety Association, the Bureau furnished many speakers and exhibits for meetings of this auxiliary group.

Following rigid tests on explosibility, the Bureau gave official approval to 31 units of electrical equipment designed for safe operation in gassy mines and extended the testing program to include trailing cables and certain other electrical equipment, resulting in some beneficial improvements. The Bureau continued certain confidential investigations on the design of safe equipment for use by the Navy Department. In connection with explosion hazards, the Bureau continued investigations on the explosibility of various dusts and powders and some of the Bureau's recommendations for the prevention and control of explosions and fires from such products have been incorporated in codes published by the National Fire-Protection Association.

Because of the increasing number of requests from noncoal-mine operators for electrical surveys similar to those made for many years in the Nation's coal mines, the Bureau assigned an electrical engineer to this work, and on the basis of preliminary recommendations numerous electrical hazards have been eliminated. The Bureau also extended this work to include quarries and hydraulic and dredging mining operations with similar favorable results.

Investigative work that ultimately may lead to revolutionary changes in underground communication systems has been continued by the Bureau at its experimental mine at Bruceton, Pa., where it has been found that communication can be conducted through the strata for distances in excess of 1,200 feet without wires or direct connections between the underground workings to the surface. With further improvements on design, the Bureau plans additional tests in producing mines. The value of such equipment, if found practicable, cannot be overestimated for greater safety in day-by-day operation, but more definitely in recovery work when persons may be imprisoned underground after fires or explosions.

To help the anthracite industry, now threatened in many areas with inundation and subsidence, the Bureau has investigated feasible pumping facilities and methods of backfilling to prevent further destruction of mines. These projects will permit the mining of large reserves of anthracite found principally in the pillars remaining after first mining.

Coal-mine inspection.—In the first 4½ years of the administration of the Federal Coal Mine Inspection Act by the Bureau of Mines, the mining industry complied voluntarily with approximately 200,000, or 35 percent, of the thousands of safety recommendations made by Federal coal-mine inspectors, improving safety conditions and protecting millions of dollars' worth of mining property. Unquestionably, the coal mines of the Nation are in a much better condition with respect to safety of operation than they were before the advent of the inspection program and there is little doubt that the Bureau's work since the passage of the act in 1941 has been a large factor in bringing about the improved condition. It is significant to note that some States have taken steps to modify their mining laws to parallel in part the Bureau's inspection standards and procedures.

Hundreds of the improvements have been of a major character, such as changing from open to closed lights and from dangerous black blasting powder to permissible explosives, providing new openings for ventilation or escapement purposes, installation of new and more powerful ventilating equipment, and adoption of procedures necessary for gassy mines in numerous mines previously operated as nongassy.

Increased attention to safety and the many voluntary improvements in mining operations resulted in a continuous reduction in the frequency rate of fatal and nonfatal injuries which dropped from 75.90 in 1941 to an all-time low of 66.77 in 1945. In the fiscal year 1946, only 3 major coal-mine disasters occurred and in these only 51 men were killed, in contrast to the 18 major disasters and 919 deaths in the coal mines of the United States in 1907. These performances were achieved in the mining industry in spite of continued heavy demands for coal coupled with the many adverse operating conditions brought about by the war.

During the year, Bureau safety experts inspected and reported on safety conditions at 2,719 mines, 320 of which were examined for the first time, and 2,399 reinspected. Virtually all of the mines of the United States employing 25 or more men have been inspected several times and the wide acceptance of the Bureau's safety proposals has been reflected in the many improvements listed in the consecutive inspection summaries. Of the approximately 7,000 regularly producing coal mines in the United States, safety inspections have been made at 3,260 operations, but these represent about 99 percent of the coal produced in 1945 and the remaining 3,740 mines, many employing less than than 25 men and not generally inspected, account for only about 1 percent of the Nation's coal output. Included among the mines inspected last year were many small operations employing fewer than 25 men on public domain and Indian lands examined in accordance with a previous order from the Secretary of the Interior.

In carrying out the Federal inspection program last year, the Bureau had a field force of 157 coal-mine inspectors, 5 mining-explosives engineers, and 5 mining-electrical engineers. Although this force performed exceptional service, a staff of at least 250 is needed to give adequate rigid inspections to the thousands of larger mines annually. Some progress toward this goal already has been made as the Congress appropriated funds to provide for the employment of 25 additional inspectors during the fiscal year 1946, and for 45 more inspectors during the fiscal year 1947.

A significant comparison is shown by statistics on coal-mine fatalities during World Wars I and II. Notwithstanding the numerous handicaps in mining in the last war, enormous pressure for maximum production of coal resulted in record-breaking performances by the industry. In the war years 1942–45, which coincided with the first 4 years of the Federal coal-mine-inspection program, the unprecedented total of 2,608,000,000 tons of coal was produced at a cost of 5,314 lives, the fatality rate being 2.04 deaths per million tons of coal produced. During 3 years of World War I, 1916, 1917, and 1918, when there was a similar demand for coal, the production was 1,919,000,000 tons with a total of 7,502 deaths, or a fatality rate of 3.91 deaths per million tons of coal produced. Thus, the United States obtained its urgently needed coal in World War II at a cost of 4,720 fewer lives than if coal-mining fatalities had been at the rate of World War I.

Explosives regulation.—Invoked with the Declaration of War on December 8, 1941, Federal regulations governing nonmilitary explosives were relaxed on October 9, 1945, eliminating the licensing provisions of the Federal Explosives Act. The Explosives Control Division was liquidated by the Bureau in December 1945, after successfully supervising transactions covering millions of pounds of explosives used in wartime by American industries.

Attesting to the efficacy of the Bureau controls, no clear-cut cases of sabotage involving explosives and blasting materials were reported to the Bureau in nearly 4 years of management of the program. Through the Bureau's efforts, hundreds of improvements were effected in the storage, transportation, and use of explosives.

In administering the Federal Explosives Act through nearly 4,000 volunteer licensing agents serving without pay, the Bureau inspected more than 40,000 explosives-storage magazines and issued or reissued about 800,000 licenses in the 48 States and Alaska, authorizing more than 300,000 persons or organizations to transact business in explosives. Only 56 licenses were revoked throughout the war years, and many of these revocations were attributed to ignorance of the provisions of the act and its regulations.

Health work.—Focusing attention on the conservation of human resources with the attending benefits of improved morale of the worker and increased efficiency of operation in the mineral and allied industries, the Bureau of Mines achieved these objectives with a broad over-all program that included investigations of unhygienic conditions in coal, metal, and nonmetal mines, naval foundries, and steel and aircraft plants, studies of underground operation of diesel mine locomotives, new advances on ventilation and air-conditioning of mines, better understanding of the physiological effects and controls of atmospheric contaminants, testing of respiratory protective devices, compilation of data on acid mine drainage, and laboratory analysis of noxious gases produced by the decomposition of cable insulation and plastic materials used in electrical equipment.

In conducting these diversified investigations and inspections of coal mines, the Bureau analyzed more than 16,000 gas and dust samples, entailing more than 100,000 individual determinations in the fiscal year. By careful study of analysis reports, Bureau safety engineers and inspectors were able to ascertain the relative danger of concentration of toxic or explosive gases and to offer suitable recommendations to correct hazardous conditions. In analyzing air samples from sealed fire areas, the Bureau determined not only the effectiveness of the seals but also the progress of the extinguishment of the fires, thus expediting recovery and rehabilitation operations with minimum hazard in the affected mine areas.

From preliminary tests on the operation of diesel mine locomotives in haulage in a number of underground metal, clay, limestone, and sand mines, the Bureau indicated that with reasonably good ventilation and approved operating procedures and maintenance, diesel engines of a suitable design may be used in mining operations without creating hazardous or unduly objectionable conditions in the air of working places. Bureau conclusions were based on the experiences of mine operators using diesel-powered equipment, analysis of exhaust gases for toxic and objectionable content, ventilating and mining methods, and properties of diesel fuels.

Because of its well-established approval program, the Bureau of Mines has been considered an outstanding authority on respiratory protective devices and many requests were supplied from industrial, governmental and other organizations for information on the performance, selection limitations, and use of such equipment.

The detailed surveys of unhygienic conditions in mines and mining, metallurgical, and petroleum plants together with laboratory studies on the determination and control of atmospheric contaminants have been beneficial in improving working conditions for thousands of industrial workers and also have increased the Bureau's already extensive information files on such subjects. In disseminating this information by publications, conferences, talks, and exhibits, the Bureau has been of material assistance to industry in instituting, developing, and maintaining programs to improve working environments.

In cooperation with the Bureau of Ships of the Navy Department, the Bureau conducted investigative work to determine the performance characteristics of several gas-indicating instruments. To evaluate possible hazards from toxic gases liberated from the burning and thermal decomposition of thermosetting synthetic resins, the Bureau has tested this material and has provided some insight into recent developments in this field.

By the development of a psychrometric chart, now ready for publication, the Bureau furthered its analysis of problems in mine air-conditioning and started a study of heat and moisture changes in airflow circuits of hot deep mines. Information on mine ventilation and fluid flow was supplied to Bureau engineers, mine operators, and others.

Because of the renewed interest in stream pollution, the Bureau has strengthened its investigations on acid mine drainage and has made some progress in developing the analytical procedures for evaluating the qualities of acid mine water which will be helpful in more efficiently applying corrective measures.

Economics and Mineral Industries

The ending of hostilities early in the fiscal year 1946 brought about a rapid conversion of the economics and statistics services of the Bureau of Mines, geared to meet an anticipated heavy demand during the reconversion period of basic information on minerals needed by the Government, industry, and the public. The end of the war permitted a substantial reduction in both the frequency and detail of many monthly statistical surveys which had provided invaluable information on production, stocks, distribution, and consumption of minerals for the guidance of industry and Government during the war. Surveys on metals and nonmetallics, particularly, were revised, but simultaneously the Bureau undertook certain surveys previously conducted by the War Production Board. In view of the continued short supply of fuels in comparison with requirements, special surveys on bituminous coal and anthracite were continued throughout the year for the Solid Fuels Administration.

Strengthened by the knowledge that the war had clearly demonstrated the need for national supplies of strategic and critical materials not available in adequate quantities from domestic sources, the Congress late in the fiscal year 1946 completed action on legislation authorizing the stock piling of these materials, ending a long controversy emphasized by the depletion of some of this Nation's mineral reserves. Because of work already accomplished during the war years in collection and dissemination of mineral statistics, the Bureau was able to refashion some of its reconverted fact-finding services to provide the basic data needed in the administration of the stock-piling act.

Although handicapped by curtailed funds with which to expand its foreign mineral services on an adequate basis, the Bureau in cooperation with the State Department made progress in drafting a program fitted for the administration of this act. However, further expansion is needed in the future in order to supply the Government with adequate information on the available supply of minerals of foreign origin.

In the modification of statistical services of the Bureau, pressing postwar problems of mineral supply and development were undertaken and progress was made in the development of economic data on domestic production and utilization of minerals for use in special studies on regionalization, mineral taxation, transportation, and other factors on the conservational use of mineral resources.

Technical services of the Bureau still were much sought after to fill an ever-increasing demand for mineral specialists to serve on numerous departmental committees and other groups dealing with national and international mineral problems.

Metals.—In keeping with the industrial transition from war to peacetime production in the fiscal year 1946, the metal-reporting services of the Bureau of Mines were readjusted rapidly to problems arising from the sharp declines in war production offset only slightly by increasing civilian production. Fortunately no drastic readjustments were required because in general the metal-reporting services developed during the war do not differ greatly from the Bureau's traditional peacetime activity.

In order to maintain the continuity of wartime metal reports, some canvasses conducted regularly in the Bureau's well-established reporting service were revised to include desirable features of reports issued by war agencies before their emergency functions were suspended. On the basis of experience gained in wartime, the Bureau redesigned canvasses and reports to shift the emphasis to all industrial minerals in contrast to the heavy emphasis on strategic and critical minerals during the war.

Because of the many complex problems arising from the disposal of Government-held inventories of metal and scrap and other surpluses, the Bureau was able to furnish up-to-the-minute factual information for the guidance of agencies charged with the disposal of property. In addition, Government agencies relied heavily on the Bureau's services to assist in price stabilization, the distribution of still scarce commodities, industrial reconversion, and the acquisition of strategic materials for permanent stock piling.

Much information developed during the war was held confidential for security reasons, but these data now have been summarized and published in conjunction with the usual monthly, quarterly, or annual reviews, supplemented by new consumption and nonferrous scrap metal surveys.

Nonmetallics.—Retaining in modified form some of its special services initiated during the war, the Bureau of Mines during the fiscal year 1946, as in past years, compiled and distributed regularly monthly and quarterly reports on commercially important nonmetallic minerals and their primary products. Of special peacetime interest to the building, chemical and fertilizer industries—as well as many other industries—was the compilation of a 21-chapter statistical review of nonmetallics for the Bureau's authoritative Minerals Yearbook.

For the first time in more than 4 years, Mineral Trade Notes, which had been issued monthly as a confidential series during the war, again was made available to the public. These Mineral Trade Notes, consisting chiefly of abstracts of consular and other reports, proved highly valuable to Government and war agencies in locating needed nonmetallic minerals.

Drawing upon its extensive and constantly growing files, the Bureau of Mines prepared many special studies in response to thousands of questions on nonmetallics from industry and individuals and continued to furnish essential data to Government and private industry during the reconversion period. Special reports were compiled on barite, graphite, tripoli, and the cement industry of the Latin American countries.

To encourage the preparation and distribution of more and better literature on nonmetallics, the Bureau undertook special work in cooperation with such organizations as the American Institute of Mining and Metallurgical Engineers and the Society of Economic Geologists.

Two Bureau of Mines experts in nonmetallics were drafted for responsible duties in occupied territories of enemy countries, one to serve in Europe as a scientific consultant under the Field Information Agency, Technical, of the War Department, and the other in Japan under the Military Geology Unit of the Geological Survey detailed to the Army Engineers Corps.

Petroleum and natural gas.—The war's almost insatiable demands for petroleum products served to emphasize further the long-range aim of the Bureau of Mines in maintaining complete information files on domestic and international supply and consumption of these important products so indispensable in war and peacetime alike. Filling in many of the gaps occasioned by wartime censorship on the dissemination of current statistics on the production and distribution of crude petroleum and petroleum products, the Bureau early in the fiscal year 1946 prepared and released several publications supplying domestic and foreign statistics on these commodities withheld from the public during the war perod from 1941 through 1944.

The International Petroleum Trade, listing monthly petroleum inventories as secured from Government Foreign Service offices and other sources, was returned to public distribution in October 1945, and a month later the Bureau resumed public issuance of monthly forecasts of estimated crude demand by States of origin which during the war had provided the Petroleum Administration for War with such a valuable gage for determining desirable rates of production. In addition to regular weekly, monthly, and quarterly reports, the Bureau inaugurated a quarterly forecast of demand for crude oil and major petroleum products, this report to be supplemented with longer term forecasts as a regular function of the Bureau.

Although some revision was made in the number of Bureau crude petroleum and petroleum products reports, experiences suggested by the war demonstrated the need for additional changes and the Bureau continued its objective for serving industry and the public by securing industry advice and assistance in improving its fact-finding program.

Coal.—Because of acute regional shortages and the continued unprecedented demand for fuels, coke, and special-purpose coals, detailed information of the Bureau of Mines based on long-time studies of bituminous coal, anthracite, lignite, and other solid fuels and byproducts proved highly valuable in insuring an equitable distribution of the available supply. Well-established statistics of the Bureau on requirements, production, shipments, and uses of these commodities were indispensable instruments in carrying out the distribution and pricing programs of the Solid Fuels Administration, War Production Board and its successor, the Civilian Production Administration, the Office of Price Administration, and other Government agencies dealing with solid fuel needs in the reconversion period.

Increased wages resulted from the reopening of wage contracts and Government agencies relied heavily on Bureau statistical data in computing allowable increases under the Government wage formula and in arriving at higher average selling prices to offset the consequent upswing in labor costs and the rise in other expenses of operation. Trained personnel and statistical records and facilities of the Bureau all were made available in working out the cost and price adjustments.

With the establishment of the Coal Mines Administration to operate mines in the possession and control of the Government, pertinent statistical and other records required by that agency were provided and trained Bureau personnel assisted in conferences on technical matters.

To supplement the well-established weekly, monthly, and annual reports published by the Bureau, a new series of reports on distribution of bituminous coal, for 12-month periods ending quarterly, was instituted and some surveys, particularly those concerning the distribution of bituminous coal, anthracite, and lignite, were expanded during the fiscal year.

Foreign minerals—Failure to receive adequate funds hampered the efforts of the Bureau of Mines to extend its facilities for obtaining foreign statistical and other economic data as provided for by Public Law 48, approved

May 3, 1945. Under legislation sponsored by the Department of State, the Bureau of Mines proposed to supersede the wartime Minerals Attaché Service by establishing 18 regions throughout the world and assigning competent technical specialists to the United States Foreign Service to aid this Government on problems relating to supplies of mineral raw materials.

The Bureau has under consideration a proposal to expand its activities in Latin American countries by providing mining and metallurgical technical assistance to Mexico similar to that already being provided to Brazil at the request of the Department of State under its cultural relations program.

Declassification of the Foreign Minerals Survey series which formed the basis of much foreign statistical data during the war permitted general distribution of comprehensive reports on the mineral resources of Japan, Latin America, Spain, and Hungary.

Accident and employment data.—With mine safety becoming an increasingly important economic consideration, Bureau of Mines injury statistics on the mineral industries became correspondingly important to serve as an unbiased measure of mining hazards on a common basis. Among many requests supplied from the Bureau's files and records were special compilations of coal-mine accident statistics and exposure-to-hazard data for use in connection with bituminous-coal wage negotiations late in the fiscal year.

In revising some of the established annual reports, the Bureau issued for the first time injury rates for certain metal-mining industries on a tonnage basis and productivity per man-hour of work and reassembled metal and nonmetal accidents statistics in well-defined industry groups on both regional and countrywide bases. Virtually completed were the compilation of injury-severity rates for coal-mine accidents and the revision of coal-mine injury rates per million man-hours to include portal-to-portal time, thus establishing a total exposure basis for the first time.

Government and private agencies directly concerned with labor problems continued to apply Bureau of Mines employment figures for the mineral industries in a variety of ways and the confidential monthly series on coal-mine employment was continued on a State-wide basis because of disturbed conditions in the solid fuels industries. In continuing surveys on industrial explosives, the Bureau supplied details on the constituents and consumption of these materials to the armed forces, foreign economic missions and those regularly interested in the industry.

Public Reports

With continuing demands from industry, Government agencies, and the public for informative material on subjects associated with the mineral industries, the volume of publications prepared and issued by the Bureau of Mines in 1946 remained at the high level typical of the war years. A considerable backlog of scientific papers and reports, withheld for various reasons during the war, was released for publication. Several of the national technical societies resumed their annual meetings after the war and Bureau staff members were called upon to write numerous articles and reports for these societies.

In all, there were 541 publications issued, either as printed or processed material, requiring the editing of about 21,500 pages of manuscript, reading proof, making indexes, and preparing 2,250 illustrations. These publications included 96 printed publications such as bulletins, technical papers, miners' circulars, data books, and Minerals Yearbook chapters; 197 mimeographed reports of investigations and information circulars; 205 papers and speeches for the technical press; and 43 miscellaneous manuscripts, together with numerous brief periodic statistical reports for the industry.

As a technologic agency with the responsibility of keeping the minerals industry and the public informed of trends and developments in mining, metallurgy, health and safety, and related fields of work, the Bureau continued to carry out its policy of the widest possible dissemination of its technologic, economic and scientific information. Nevertheless, the number of copies of each publication printed and distributed was restricted to the minimum to save funds and material.

With 2,863 books and pamphlets and 236 volumes of bound periodicals added during the year, the Bureau's Washington library of selected reference material now has a total of 65,061 items. At the year's end, 320 periodicals had been received and recorded and 228 of them were routed regularly to staff members. Outside of the library, 23,980 periodicals and books were lent or routed. Nearly 5,000 people came to the library to use material and there were approximately 4,000 telephone inquiries. A total of 2,770 books were cataloged and 8,000 cards were added to the card catalog.

The educational motion picture program of the Bureau of Mines enjoyed one of the most successful years since its inception more than 25 years ago. The films, distributed free to schools, colleges, training classes, engineering and scientific societies, and business and civic groups, are produced under the supervision of the Bureau and paid for by private industry. There is no advertising in the films, and the sponsor's name appears only at the beginning and end of each picture.

Last year the Bureau's educational films were shown on 92,934 occasions to audiences totaling 7,893,218 persons. As of June 30, 1946, the Bureau's film library had 10,952 reels in circulation, with a total footage of 4,258,456 feet. During the year the Bureau added 563 sets of pictures, consisting of 1,500 reels, to the library.

Four new pictures in 16-millimeter sound were completed and released for showing in 1946. They were The Story of Texas and Its Natural Resources, The Evolution of the Oil Industry (revision of an earlier film), The Story of Arc Welding, and Tin from Bolivia.

The Texas State film, which met with wide acclaim throughout the country, appears to be the forerunner of a series of State films. The Bureau has received numerous requests from prospective sponsors of similar films, and two more State pictures—on Oklahoma and Ohio—are in varying stages of production and are expected to be released during the 1947 fiscal year.

Administration

As in past years, activities of the Bureau of Mines were administered from Washington, D. C., but carried on largely in the field offices, laboratories and pilot plants. In order to administer more effectively the problems arising in connection with wages of unclassified employees, arrangements were made to handle rate determinations by wage boards organized on a regional basis.

Personnel.—On June 30, 1946, there were 3,375 full-time employees in the Bureau of Mines, distributed as follows:

Classification and number of appointees

	P & S	SP [1]	CAF	CPC [2]	Total
Department	138	1	501	14	654
Field	865	344	653	859	2, 721
Total	1, 003	345	1, 154	873	3, 375

[1] Includes instrument makers, safety instructors, laboratory aids, assistants, etc.

[2] Includes laborers, mechanics, messengers, wage employees, etc.

Property—As of June 30, 1946, the property of the Bureau had a total valuation of $12,094,641.98, of which $3,157,089.14 was for land, buildings, and improvements; $3,066,080.29 for laboratory equipment $2,780,691.24 for machinery and power-plant equipment; and the remainder for automobiles and trucks, office furniture and equipment, rescue cars and specialized apparatus, and other goods.

Finance.—The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1946, including direct appropriations, departmental allotments, reappropriated balances, and sums transferred from other departments for service work, were $25,301,457. Of this amount $17,250,648 was spent, leaving an unexpended balance of $8,050,809. On the regular work of the Bureau, $16,009,760 was expended. These figures are subject to revision because of unpaid obligations.

Table 1 presents classified information regarding the financial history of the Bureau for the fiscal years ended June 30, 1943–47.

Table 2 gives a statement of the distribution of congressional appropriations to the services and divisions and the expenditure of these funds in 1946 by Bureau divisions.

TABLE 1.—*Bureau of Mines appropriations and expenditures, fiscal years ended June 30, 1943–7*

Fiscal year	Appropriated to Bureau of Mines	Departmental allotments [1]	Funds transferred from other departments [2]	Total funds available for expenditure	Unexpended balances	Total expenditures	Expenditures, exclusive of service items [3]
1943	$28,707,630.94	$106,450	$2,567,615.26	[4] $32,168,548.20	[5] $5,851,566.64	$26,316,981.56	$25,178,429.84
1944	20,969,098.00	91,300	3,460,898.00	[5] 25,476,222.00	[6] 5,654,660.00	19,821,562.00	17,962,090.00
1945	22,195,136.55	91,500	6,260,167.74	[6] 28,988,520.00	[7] 8,556,166.67	20,432,353.33	19,656,644.67
1946	17,846,838.69	[9] 6,500	2,384,271.00	[7] 25,301,457.69	[8] 8,050,809.69	17,250,648.00	16,009,760.00
1947	16,000,515.00	[9] 7,800	457,416.00	[8] 20,099,801.12			

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[1] Includes printing and binding, stationery, and contingent funds.

[2] Includes proceeds from sales of residue gas.

[3] Service items include helium, and other investigations and services for other departments.

[4] Includes $976,885.27 unexpended balance reappropriated, and balance of $128,018.51 receipts from sale of helium and other products.

[5] Includes $4,606,720.72 unexpended balance reappropriated, and balance of $202,723.66 receipts from sale of helium and other products.

[6] Includes $4,603,644 unexpended balance reappropriated, and balance of $291,152 receipts from sale of helium and other products.

[7] Includes $4,678,164 unexpended balance reappropriated, and balance of $385,684 receipts from sale of helium and other products.

[8] Includes $3,176,386.12 unexpended balance reappropriated, and balance of $457,684 receipts from sale of helium and other products.

[9] Includes stationery and contingent funds.

TABLE 2.—*Bureau of Mines expenditures, fiscal year 1946*

Division or branch	Salaries and expenses	Operating rescue cars and stations and investigation of accidents	Coal-mine inspections and investigations	Salaries and expenses, enforcement of Federal Explosives Act	Testing fuel	Anthracite Investigations	Synthetic liquid fuels	Mineral mining investigations	Oil and gas investigations	Expenses mining experiment stations	Care, etc., buildings and grounds, Pittsburgh, Pa.
Office of the Director	$42,962						$298			$26	
Office of Minerals Reports	5,267	$19,738	$37,028		$9,417	$3,242	44,971		$2,438	2,733	
Total	48,229	19,738	37,028		9,417	3,242	45,269		2,438	2,759	
Administrative Service	57,553	16,445	12,872	$5,468	9,627	22	77,597	$26,750	28,784	34,880	
Mining Branch	1,349							145,440		112,083	
Metallurgical Branch	7,426							242,623		750,974	
Fuels and Explosives Branch:											
Coal Division	8,660	185,373	52,632		299,149	35,775	103,007			60,061	$161,282
Explosives Division		132,281									
Petroleum and Natural Gas Division	1,412						1,402,477		546,544		
Synthetic Liquid Fuels Division							3,948,010				
Total	10,072	317,654	52,632		299,149	35,775	5,453,494		546,544	60,061	161,282
Economics and Statistics Branch:											
Coal Economics Division	2,017										
Foreign Minerals Division											
Metal Economics Division	36,923		4,445								
Accident Analysis Division	2,058		19,170								
Nonmetal Economics Division	774										
Petroleum Economics Division	70										
Total	41,842		23,615								
Health and Safety Branch:											
Coal Mine Inspection Division	2,720		922,749								
Safety Division	4,917	430,090	20,194			26,165					
Health Division	193	61,667	57,894								
Explosives Control Division				66,600							
Total	7,830	491,757	1,000,837	66,600		26,165					
Total appropriations	175,200	846,000	1,127,240	72,100	320,000	66,000	9,403,399	417,700	579,000	962,200	161,750
Total expenditures	174,301	845,594	1,126,984	72,068	318,193	65,204	5,576,360	414,813	577,766	960,757	161,282
Balances	899	406	256	32	1,807	796	[1] 3,827,039	2,887	1,234	1,443	468

Division or branch	Economics of mineral industries	Investigation of raw material resources for steel production	Construction and equipment of helium plants	Maganese beneficiation pilot plants	Production of alumina from low-grade bauxite, aluminum clays and alunite	Investigation of bauxite and alunite ores and aluminum clay deposits	Magnesium pilot plants and research	Investigation of deposits of critical and essential minerals in the United States and its possessions	Helium utilization and research	Helium production	Reduction of zinc concentrates with methane gas
Office of the Director							$1,076				
Office of Minerals Reports	$18,544	$19,386			$2,491	$52	6,886	$23,436			
Total	18,544	19,386			2,491	52	7,962	23,436			
Administrative Service	50,944	33,308	$5,279	$18,717	20,646	22,109	8,418	56,797	$1,243	$31,007	
Mining Branch		441,614						1,032,368			
Metallurgical Branch		544,002		379,818	424,019	125,610	229,532	256,336			$74,324
Fuels and Explosives Branch:											
Coal Division		26,718						298,091			
Explosives Division											
Petroleum and Natural Gas Division			165,874						75,682	440,784	
Synthetic Liquid Fuels Division											
Total		26,718	165,874					298,091	75,682	440,784	
Economics and Statistics Branch:											
Coal Economics Division	159,824										
Foreign Minerals Division	78,038										
Metal Economics Division	216,605										
Accident Analysis Division	55,720										
Nonmetal Economics Division	69,117										
Petroleum Economics Division	52,326										
Total	631,630										
Health and Safety Branch:											
Coal Mine Inspection Division											
Safety Division											
Health Division											
Explosives Control Division											
Total											
Total appropriations	705,000	1,070,000	844,627	400,000	450,000	150,000	250,000	1,680,000	78,400	2,903,528	77,506
Total expenditures	701,118	1,065,028	171,153	398,535	447,156	147,771	245,912	1,667,028	76,925	471,791	74,324
Balances	3,882	4,972	[1] 673,474	1,465	2,844	2,229	4,088	[1] 12,972	1,475	[1] 2,431,737	[1] 3,182

TABLE 2.—*Bureau of Mines expenditures, fiscal year 1046*—Continued

Division or branch	Drainage tunnel, Leadville, Colo.	Development and operation of helium properties (special fund)	Salaries and expenses, Solid Fuels Administration for War	Working funds	Cooperation with the American republics	Contingent expenses	Total
Office of the Director			$144				$44, 506
Office of Minerals Reports			10, 381				206, 010
Total			10, 525				250, 516
Administrative Service		$1, 006	23, 356			$6, 457	549, 285
Mining Branch				$98, 989			1, 831, 843
Metallurgical Branch							3, 034, 664
Fuels and Explosives Branch:							
Coal Division			92, 245	533, 862			1, 856, 855
Explosives Division				5, 088			137, 369
Petroleum and Natural Gas Division		36, 206		25, 857			2, 694, 836
Synthetic Liquid Fuels Division							3, 948, 010
Total		36, 206	92, 245	564, 807			8, 637, 070
Economics and Statistics Branch:							
Coal Economics Division			560, 612				722, 453
Foreign Minerals Division				57, 405	$12, 941		90, 979
Metal Economics Division							315, 378
Accident Analysis Division			15, 521				92, 469
Nonmetal Economics Division							69, 891
Petroleum Economics Division							52, 396
Total			576, 133	57, 405	12, 941		1, 343, 566
Health and Safety Branch:							
Coal Mine Inspection Division							925, 469
Safety Division				10, 515			491, 881
Health Division							119, 754
Explosives Control Division							66, 600
Total				10, 515			1, 603, 704
Total appropriations	$37, 381	494, 896	703, 000	1, 307, 030	13, 000	6, 500	25, 301, 457
Total expenditures		37, 212	702, 259	731, 716	12, 941	6, 457	17, 250, 648
Balances	[1] 37, 381	[1] 457, 684	741	[1] 575, 314	59	43	8, 050, 809

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[1] Available for expenditure in fiscal year 1947.

Geological Survey

W. E. WRATHER, *Director*

Geologic Branch

THE fiscal year 1946 was in many ways a year of transition, and the activities of the Geological Survey were of necessity divided. A large proportion of the work of the Geologic Branch consisted of the preparation of reports on the varied and valuable projects carried on during the war. As the year progressed, however, an increasing amount of attention was given to the Survey's normal function of long-range geologic research.

Metals and Nonmetallic Minerals

In the study of metals, 45 major projects were carried on, of which 14 were completed during the year. About two-thirds of these investigations were of deposits of the base metals—copper, lead, zinc, and iron—with particular attention paid to lead and zinc. Because of the great depletion of our reserves of the base metals during the war, plans for the future call for continued extensive exploration. The major projects were carried out in 18 States, in 7 of which part or all of the work was done in cooperation with State agencies. Three major projects were carried out in the Missouri River Basin as a part of the development program of the Department of the Interior. In all, 16 geologic reports accompanied by maps, were published, and 30 other reports were placed in open files for public inspection.

In the field of nonmetallic minerals, fluorspar investigations were continued in seven States, many of them in cooperation with State organizations and the Bureau of Mines, and four bulletins were published. Field investigations of pegmatite deposits containing mica, lithium minerals, tantalum, beryllium, and feldspar were curtailed, but reports on the deposits of six States have been completed, and reports on other States are nearing completion. Deposits of high-alumina clay were studied in a number of States, and reports on the investigations are being prepared. Field surveys designed to aid the search for new deposits of talc and potash were continued, and maps showing the location of nonmetallic mineral resources and construction materials in the Missouri River Basin were prepared and published.

Fuels

Continuing its program of regional geologic studies to aid the intensified search for new supplies of oil and gas, the Geological Survey conducted investigations in 20 States. The work was directed primarily to the accumulation and interpretation of fundamental geologic data necessary to delineate new areas in which the geologic structure is favorable for the occurrence of oil and gas. In conducting this program the Geological Survey has received the active collaboration of the oil and gas industry, State geological surveys, and other geologic organizations whose work contributes to but does not duplicate that being undertaken by the Federal survey. Most of the results of the current work are embodied in a series of preliminary maps and charts, on which are printed brief explanatory texts. These are usually published within a few months after the manuscript reports of the field parties are received in Washington. During the fiscal year, 34 such reports were printed by the Geological Survey, and more than 23,000 copies were distributed.

To appraise the potentialities and reserves of substitutes for liquid petroleum the Geological Survey, in cooperation with the Navy Department and the Bureau of Mines, completed during 1946 a study of the oil-shale deposits in naval oil shale reserves Nos. 1 and 3 in western Colorado. The results of this work showed much larger resources of shale oil than had been anticipated originally and served to emphasize the need for additional work of a similar nature in large, essentially unsurveyed areas of oil shale in the Rocky Mountains and other regions. The low-rank coals, which, like the oil shales, occur most abundantly in the Rocky Mountain region, are also a potential source of petroleum substitutes and should be the immediate subject of investigation in order to obtain adequate information concerning the distribution and available reserves. The quantity, quality, and distribution of these two sources of petroleum substitutes are major factors in the development of techniques for their utilization.

The search for new supplies of coking and special-purpose coals was continued during the year, largely in cooperation with the Bureau of Mines, in Colorado, Washington, Alabama, Georgia, and Maryland.

Areal Geology

Extensive and systematic geologic surveys planned for the postwar years were begun during 1946. These surveys are to provide geologic maps containing basic data needed by soil scientists and engineers, as well as in the search for hidden deposits of minerals. Work on these maps is being done in cooperation with State agencies and with such Federal agencies as the Bureau of Reclamation and the Bureau of Plant Industry, Soils, and Agricultural Engineering, Department of Agriculture. During 1946, 13 quadrangle maps covering approximately 1,650 square miles in the States of Massachusetts, Montana, North Dakota, Rhode Island, and Wyoming were completed. Mapping was under way in 28 additional quadrangles in these States and in New Mexico and Texas. Work on a small-scale geologic map of the State of South Dakota was completed, and work on a similar map of Montana continued.

During 1947 the program of large-scale geologic mapping will be stepped up and will include several of our national parks and monuments, where the availability of increased geologic information will add materially to public appreciation of the scenic beauties and varied natural resources.

Special projects carried out in 1946 included a study of shore-line changes in Massachusetts, where much property was damaged during the great storms of 1944–45, and a study of the occurrence of selenium in bedrock in South Dakota to delineate belts wherein plants concentrate amounts of selenium that are poisonous to grazing stock.

Engineering Geology

Engineering geologists within the geologic branch are devoting their efforts to the collection, interpretation, and dissemination of geologic data for the use of engineers. This group has its headquarters in Denver, Colo., where they work in close cooperation with the engineers of the Bureau of Reclamation. During 1946 they prepared preliminary maps showing deposits of sand and gravel and other construction materials in six States and made detailed engineering geologic studies of four quadrangles in North Dakota. Other projects that were begun during the year and will be continued in 1947 include studies of reservoir sites, landslides, mine waters, and various kinds of subsurface data of interest to construction engineers. In cooperation with the Public Roads Administration, special engineering soil maps of certain areas are being prepared, and systematic studies of the physical properties of rocks have been started.

Basic Research

Specialized groups of scientists in the Geological survey spent most of their time during the war in furthering the work of the economic geologists on projects directly concerned with the search for needed war materials. In this group are chemists, physicists, petrologists, and paleontologists. In increasing numbers they are now being returned to their normal pursuits. The chemists and physicists are conducting basic research on analytical methods and determinations of radioactivity, on spectrographic procedures and X-ray techniques. The petrologists are expanding their studies of many minerals, particularly clay minerals and related substances that eventually may become valuable sources of aluminum and zinc. The paleontologists, while continuing to support the work of the economic geologists by furnishing data derived from the study of fossil collections, are resuming general studies of fossil faunas and floras that were interrupted by the war.

During 1946, air-borne magnetometer surveys covering about 70,000 square miles were made by the Geological Survey in cooperation with the Office of Naval Petroleum and Oil Shale Reserves. The surveys were made over potential oil-producing areas in northern Alaska, Wyoming, New Mexico, and the coast of the Gulf of Mexico, and over magnetic iron regions in the Adirondacks. The instrument has been modified and field methods have been improved so that large areas can now be surveyed more rapidly and more accurately than by ground magnetic methods—the air-borne method is 50 to 500 times faster and provides more detailed data.

The air-borne magnetic surveys made during the past two years were largely experimental; most of them covered from a few hundred to a few thousand square miles. Plans for the fiscal year 1947 call for surveys of much larger areas, such as the Lake Superior iron and copper regions and eastern and southwestern mining and fuel-producing regions. These surveys will be made primarily to obtain information on the structure of the rocks and on economic geology.

The evaluation of domestic resources of fissionable materials needed in atomic research has entailed field work in 32 States and has disclosed much new and valuable information. Reconnaissance investigations of State-wide areas have successfully delimited local areas in which detailed study was warranted, and research on the geophysical and geochemical properties of these materials, conducted both in the field and in the laboratory, has resulted in a further refinement of the techniques of exploration and detection. Long-range research on the properties of fissionable materials has been started to obtain further data. This program has definite postwar value because the new uses for fissionable materials, either actual or potential, make it imperative that we adequately appraise our domestic resources.

Military Geology

The Military Geology unit in 1946 prepared 12 comprehensive intelligence reports for the Corps of Engineers. These reports concerned terrain, water supply, construction materials, mineral resources, and correlation of mines detector performance with soil and rock characteristics. A special terrain intelligence folio on the Fort Knox Reservation, Ky., was prepared at the request of the Armored Forces and will be used for training purposes. A manual of military geology, requested by the Engineer Board, Fort Belvoir, for use in officer training, was virtually completed at the end of the fiscal year.

Beginning in October 1945 a large group of geologists was assigned to Natural Resources Section, General Headquarters, Supreme Command Allied Powers, in Tokyo, forming the main part of the Mining and Geology Division. They made studies of Japan's mineral resources, metallurgical plants and processes, coal, construction materials, and water resources.

Many short reports were prepared, and by the end of the fiscal year 25 special reports were virtually completed. Similar work was done in Korea.

Field work was begun on a geologic map of Okinawa. This work is expected to be completed in the coming year, when similar studies will be undertaken in Palau, Guam, Yap, and Saipan.

Detailed geologic studies of Bikini Atoll were made prior to the atomic bomb tests. These surveys will be repeated after the bombing to determine the effects of the explosions on the islands, the reefs, and the floor of the lagoon.

Two geologists assigned to the general engineer district, Manila, are engaged in making surveys of construction materials to aid in the rebuilding of Manila. They are also cooperating with the Philippine Bureau of Mines in a program designed to develop the valuable mineral deposits of the islands.

Work in Other American Republics

In Mexico, Cuba, Brazil, and Peru, 14 mineral commodities were studied cooperatively under the auspices of the State Department. Geologic investigations were carried on in the vicinity of Mexico's new volcano, Paricutin; a geologic map of the area was completed, and a new topographic map, based on recent air photographs, is being compiled.

In Chile a reconnaissance of the mineral deposits of the Southern Archipelago was begun, and ground-water studies were undertaken in the central and northern parts of the country. These investigations, which were requested and financed by the Chilean Government, will be continued into 1947.

Some of the tin deposits of Bolivia and the manganese deposits of Cuba were investigated with funds furnished by the Foreign Economic Administration.

Four training grants were awarded to Latin-American students of geology. Two of these were given to Mexicans and two to Peruvians, the funds being supplied by the State Department.

Alaskan Branch

The work of the United States Geological Survey in Alaska is directed primarily toward aiding in the development of the mineral resources of the Territory. This has involved field investigations in the course of which the known productive camps have been examined and about 300,000 square miles, or approximately half of Alaska, has been mapped topographically and geologically on reconnaissance standards. Many of the activities carried on during the war years and continuing through the 1946 field season have been relatively detailed examinations of specific areas or deposits, the results of which have been made available to appropriate war agencies, largely in the form of preliminary reports and maps. The distribution of many of these publications is still restricted because of War Department regulations, but they are being released to the public as rapidly as possible.

The war years have seen a greatly increased public interest in Alaska, which is already beginning to express itself in long-awaited postwar ventures on the part of both private interests and Territorial management. The objectives of the Alaskan Branch in its expanded postwar program reflect this interest. The investigations by the technical personnel engaged in field studies during the field seasons, which are short because of the unusual climatic conditions, has resulted in the issuance of a series of reports covering detailed examinations of a large number of mineral deposits, some whose worth was previously undetermined, others whose very existence was uncertain. Though few of these deposits have as yet reached the stage of commercial development, many stand available as sources of added raw materials to replenish the stock piles that dwindled during the war. As a result of these relatively limited studies the known reserves of many of the economically important minerals in Alaska have been substantially increased. For example, quicksilver, formerly considered a resource of only minor significance, has become one of the important commodities now commercially produced in Alaska. The explorations by Alaskan Branch geologists have revealed additional coal reserves estimated at millions of tons.

Past Mineral Production

The importance of mineral resources as a factor in the development of Alaska is indicated by the prewar cumulative production of minerals worth more than $800,000,000. This is further emphasized by the fact that in the last prewar year (1940) the value of the mineral production was the greatest in the history of the Territory.

The mining of gold has been Alaska's major industry. Gold produced prior to 1940 amounted to more than $600,000,000. The year of lowest mineral production was 1927. Since that time, owing in part to the increase in price of gold from $20.67 per ounce to $35 per ounce and in part to improved mining methods, the quantity of gold produced has increased more than 260 percent and its dollar value has increased more than 430 percent. Although seriously curtailed during the war, gold mining has shown a strong recovery since the cessation of hostilities.

As byproducts of the production of gold, silver worth more than $14,000,000 and lead worth nearly $3,000,000 have been produced. The increase in the amount of silver has been in proportion to the total quantity of gold produced, because all crude gold contains a few percent of silver. The amount of lead has varied in proportion to the amount of gold taken from lode mines, because lead is a byproduct of lode-gold mining.

In contrast to the wartime slump in the production of gold and associated metals, the demand for coal has greatly increased. The value of coal mined prior to 1940, about $14,000,000, in no way represents the potential capacity of Alaska to produce coal. Field work during the war years has disclosed reserves which, if developed, would be ample to provide for any predictable increase in demand, and other areas known to be coal-bearing have not yet been investigated.

Future Development

Alaska's mineral resources have been so slightly tapped, despite the forced production of certain commodities during the war, that any calculation in terms of dollars and tonnage reserves can be at best only a rough approximation, but the known value of Alaska's mineral resources can be set at a minimum of several billions of dollars.

The efforts of the Alaskan Branch, never numbering more than the 53 geologists at its present peak and through most of the half century of its life only between 5 and 10, have been widely spread over most of Alaska's nearly 600,000 square miles of country and have resulted in the accumulation of a considerable body of sound and lasting information; but the task ahead is tremendous.

The accelerated program carried on during the war was coordinated with anticipated future development of the Territory. The war has stimulated Alaska. Many of the thousands of servicemen who passed through or were stationed in Alaska have become greatly attracted to the Territory; never again will there be the lack of interest that formerly existed. With the growing interest in Alaska are coming increased inquiries as to the possibilities there for newcomers. An important part of the work of the Alaskan Branch will be the meeting of the demands for information from servicemen, private citizens, and corporations. As a result of its war activities the Branch is better able than at any time in the past to reply adequately to such questions; but far more work is needed to keep pace with the growing demands.

The future settler in Alaska can be helped immeasurably in planning his new life, and the development of the Territory on a sound basis can be expedited if the Alaskan Branch and other Government agencies, each in its respective field, are able to supply the needed answers. Alaska's development must be based on a sound and enduring economic structure which has been established with an understanding of the aims and methods of true conservation, not only for the safeguarding of resources but also to insure the success of prospective citizens in their varied ventures.

One of the prime requisites for the establishment and maintenance of a highly developed civilization is the production and regular revision of a series of large-scale topographic maps of high detail and accuracy. The most efficient development of any area is impossible without careful study of such maps. The most desirable locations for townsites, highways, reservoirs, airports, and a myriad of other works of man require, at least initially, a careful examination of detailed topographic maps. As a result of its work for the Army Air Forces, small-scale aeronautical pilotage charts have been completed by the Branch for the greater part of the Territory; but these, while they will serve as a springboard for future mapping activity, are inadequate to meet the demands of a developing civilization. Less than 1 percent of Alaska has been mapped in the detail and accuracy considered essential in the United States for areas of only moderate development.

With the production of adequate detailed maps should come a greater intensification of diversified geologic examinations. Before the war the emphasis was placed on investigations contributory to the production of gold; during the war it was placed on the development of minerals essential to the war program; since the end of the war the emphasis logically has shifted to a program of diversified mineral production. The development of deposits of nonmetallic mineral commodities, such as limestone, gypsum, marble and other building stones, clay, gravel, and sand, may make important contributions to the establishment of a sound and stable society in Alaska. Alaska's fuel resources, her coal and perhaps petroleum, when adequately developed, may prove sufficient not only for her own needs but to sustain a considerable export trade as well. Many such materials or their finished products are now being shipped to Alaska, though her own reserves, as yet practically untouched, might be able to offer the same or better materials with lower costs and greater efficiency. Along with the postwar development of such mineral resources the Alaskan Branch must continue at an increased tempo the delimitation of areas in which the production of metallic minerals is or may become possible. It is the Branch's duty to provide the basic information necessary for the continuation, expansion, and greater diversification of Alaska's mineral industry.

Field Season of 1945

During the 1945 field season, which included the latter part of the fiscal year 1945 and the earlier part of the fiscal year 1946, the work of the Alaskan Branch was directed exclusively to projects designed to make the maximum contribution to the Nation's war effort. The need was recognized for keeping the activities as flexible as possible to meet changing war conditions. Many of the more general and broader studies that had been carried on over a period of years and would require additional work for their completion were temporarily laid aside so that the efforts of the technical personnel of the Branch could be focused closely on the investigation of areas or deposits that seemed most likely to become producers of strategic and critical minerals needed in carrying on the war and on related activities of direct war pertinency. Conclusions and results were sought that would be specific and of definite value to those Government agencies and private individuals immediately concerned with the development of such reserves. Particular attention was given to petroleum, coal, and quicksilver. The working season of each field party was planned to extend to the maximum feasible under the climatic conditions prevailing in that area. This policy continued to the end of the season despite the conclusion of the war in August.

Field Season of 1946

The end of the war early in the fiscal year 1946 brought a change in the emphasis placed on war-sponsored projects. Plans being carried out in 1946 show a marked revival of the normal pre-war program of geologic mapping in Alaska. The partial reversion to peace-time activities is reflected also by the resumption of the long-range investigations in areas considered to be potentially valuable as mineral producers.

Certain of the programs which were supported by the Army or the Navy during the war years as urgent war-time measures have proved to be of general scientific interest as well. The Alaskan Branch geologists assigned to some of these projects, such as permafrost and volcano investigations in the Aleutian Arc, developed techniques and accumulated knowledge too valuable to be shelved as the war ended. The Alaskan Branch has allotted funds for continuation of both of these projects.

In the fiscal year 1946 and during the 1946 field season the Alaskan Branch has carried on eight programs of special investigation, each under the direction of a supervisor. The eight groups are metals, nonmetals, northern Alaska oil, southern Alaska oil, coal, permafrost, volcano studies, and Alaska mapping. Of special interest is the Aleutian volcano program which, during the fiscal year 1946, was supported wholly by funds transferred to the Geological Survey by the War Department. Field work during the present field season is being conducted on Mount Pavlof, on Umnak Island, and on Great Sitkin Island, as well as reconnaissance surveys directed toward the planning of future projects. A major purpose of the program is to analyze volcanic phenomena so that it may be possible eventually to predict destructive activity and by advance warning reduce the danger to Army installations and personnel. It is hoped that the progress made so far will warrant continued support by the War Department in the fiscal year 1947.

Mapping Activities

The major mapping activity of the Alaskan Branch during the 1945 field season was a continuation of the Army Air Forces program, in which aeronautical pilotage maps and charts of areas throughout the world were compiled from photographs furnished by the Army Air Forces.

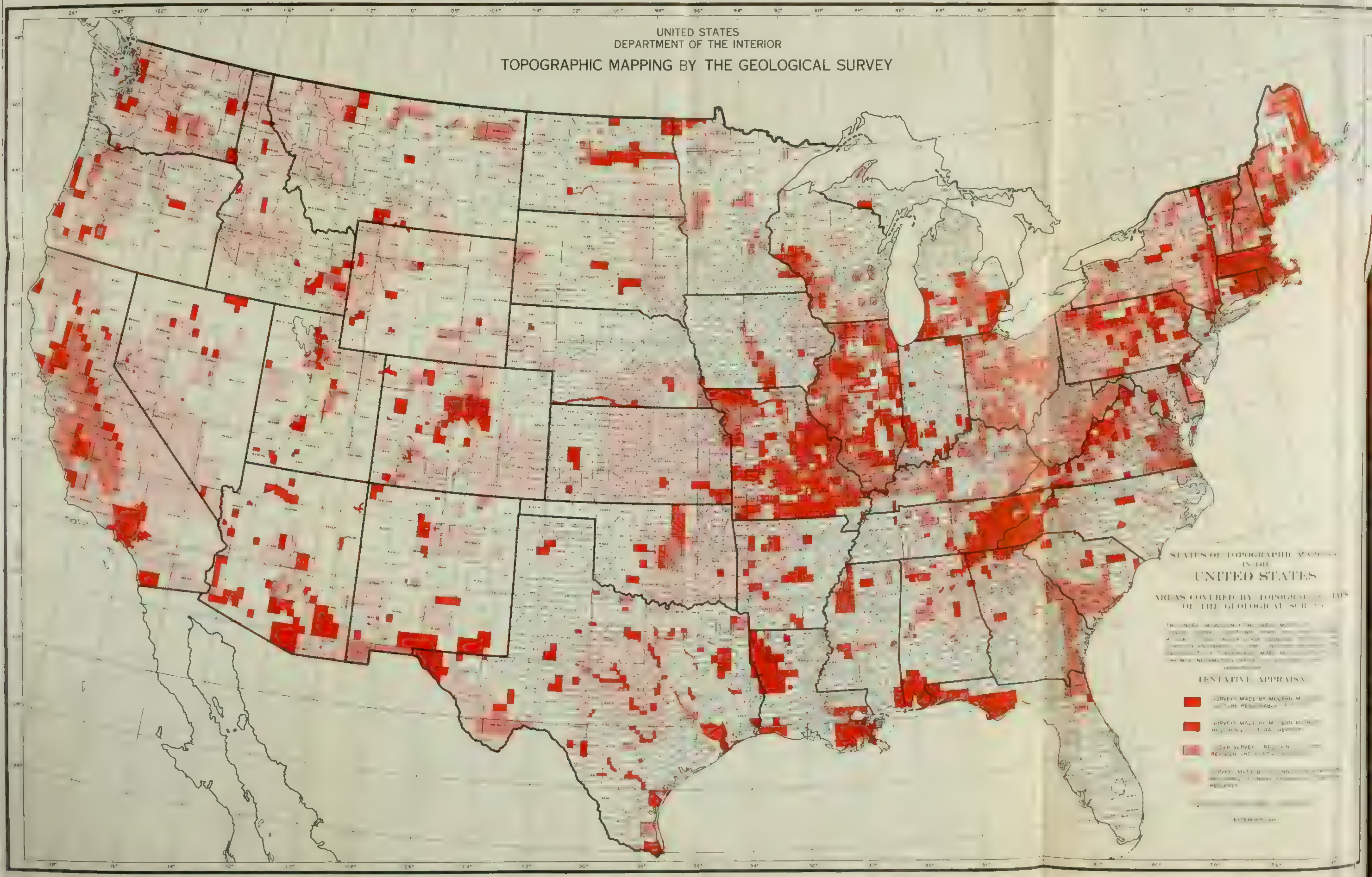
The prewar program of topographic mapping in Alaska has been partially resumed. Topographic maps prepared by the Alaskan Branch of the Geological Survey are utilized by governmental agencies, commercial firms, and private individuals for a great variety of purposes, such as the following: Tracing waterways for transportation and water supplies; locating trails, highways, railroads, pipelines, and lines of communication; study of terrain for the location of bridges, dam sites, power plants, and other industrial plants; estimating the possible water supply for placer mining and other industrial operations; classification of public lands and mapping of agricultural land, national forests, Indian reservations, mineral lands; plotting the aerial extent of rock formations and working out geologic structure.

A recent order by the Director of the Geological Survey, effective July 1, 1946, provides for the transfer of the topographic mapping facilities and commitments previously vested in the Alaskan Branch, together with such funds as have been allotted or transferred for the purpose, to the Topographic Branch of the Geological Survey. Thus, beginning in the fiscal year 1947 the responsibilities for the various phases of topographic mapping in Alaska will be the concern of the Topographic Branch. It is contemplated that other technical activities of the Alaskan Branch will shortly be transferred to the appropriate functional branches and that proper coordination and integration of all Alaskan activities will be attained through a proposed staff Alaskan geologist, who will be a part of the Director's office. This reorganization within the Geological Survey has been decided upon after long study of the many problems arising out of the great increases in Alaskan activities and Geological Survey responsibilities. It is designed to attain the most efficient use of highly specialized technical personnel and thus effect a more comprehensive and well-balanced pursuit of the studies that contribute so largely toward shaping the social and economic future of the Territory.

Topographic Branch

Topographic maps are fundamentally essential to a survey of the country's resources and are highly valuable for the economical and efficient planning of drainage, flood control, irrigation, water supply, hydro-electric, and transportation projects; they minimize the number of expensive field surveys needed in connection with the location of transmission lines, railways, highways, canals, tunnels, airports, and industrial plants and thereby reduce the cost of construction; they provide topographic data essential to the proper location of frequency-modulated and television radio stations; and they are essential for recording and correlating data obtained from geologic investigations, thus aiding immeasurably in the location, evaluation, and development of our mineral wealth. Maps of this kind provide information necessary for the proper classification and best utilization of the public lands, the conservation of the soil, and the administration and protection of the forests, both State and National.

Topographic mapping in the United States has proceeded at such a slow pace that only a relatively small part of the country may be considered sufficiently well mapped to meet present-day requirements. Half of the nation is without topographic maps; of the maps available to the other half, some are considered adequate for present-day requirements, but others are of too


UNITED STATES
DEPARTMENT OF THE INTERIOR
TOPOGRAPHIC MAPPING BY THE GEOLOGICAL SURVEY
STATUS OF TOPOGRAPHIC MAPPING
IN THE
UNITED STATES
AREAS COVERED BY TOPOGRAPHIC MAPS
OF THE GEOLOGICAL SURVEY
TENTATIVE APPRAISAL
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low quality to meet the varied needs. In the vast domain of public lands, enormous areas have never been mapped; consequently the administrative officials responsible for enforcement of the public land laws are without detailed knowledge of their extent, the character of the terrain, their intrinsic value, or the possibility of their development.

Recognizing the urgent need for topographic maps, the Geological Survey is preparing a report reviewing the status of mapping. A program of sufficient scope to provide adequate maps for the entire Nation within a period of 20 years is being submitted, with recommendations for the enactment of legislation that will make this program effective. The entire 20-year program has been evaluated in its relation to the needs of all Government agencies in order to avoid duplication of effort, to assure uniformity in mapping, to utilize the most efficient modern methods, and to provide the essential maps when and where needed.

Attention is invited to the small summary index map which faces this page. Although about 48 percent of the country is topographically mapped in some manner, much of the older work was accomplished by rapid reconnaissance methods. Less than a quarter of the country is covered by maps considered adequate for present-day requirements and, as the index shows, a considerable number of these maps should be revised for culture or other details to afford satisfactory coverage for modern use.

General Office Work

With the termination of hostilities and return to domestic mapping, the greatly expanded mapping program, as well as improved mapping technique, necessitated reassignment of certain functions within the Topographic Branch. The large amount of work involved in planning and supervising necessitated creation of a staff of engineers to assist the Chief Topographic Engineer to carry out this program.

As part of the plan for reorganization of the Geological Survey, all activities of the Alaskan Branch pertaining to topographic mapping and the making of aeronautical charts for the Air Forces were transferred to the Topographical Branch, effective July 1, 1946. That portion of the work pertaining to topographic mapping in Alaska is to be placed in the Rocky Mountain Division. As part of the same plan the drafting unit of the Section of Inspection and Editing and the functions of the Section of Photomapping, with the exception of the Research and Development Unit, were transferred at the same time to the Atlantic Division.

During the fiscal year 1946 headquarters offices were maintained for the Topographic Branch and Atlantic Division in Washington, D. C.; the Central Division in Rolla, Mo.; and the Pacific Division in Sacramento, Calif. The Rocky Mountain Division was reactivated with headquarters in Denver, Colo. Section offices were maintained in Chattanooga, Tenn., and Arlington, Va.

The major part of the first quarter of the year's activities of the Topographic Branch was directed toward producing maps in manuscript form from aerial photographs made for the War Department. Approximately 80 percent of the time and services of the personnel of the Arlington and Chattanooga groups was devoted to the mapping or supervision of mapping of areas in foreign countries for use of the Armed Forces during that period.

Section of Computing.—The results of geodetic control surveys, which constitute the framework for detailed mapping, are computed, tabulated, and reproduced by the Section of Computing. Lists of reference marks, showing elevations and geographic positions, are furnished to topographers and geologists of the Geological Survey and to surveying units in other governmental organizations. Such data are available also, for limited areas, to civil engineers, surveyors, and geophysical prospectors throughout the United States. During the year, lists of reference marks for 452 quadrangle map areas were issued in lithographed form, and others were prepared as typewritten manuscripts.

Continuous research for new and improved methods for control surveys and computing is another function of this section. During the year a method for determining elevations by precise altimeters was tested and adapted to mapping requirements. Many forms and special tables have been devised so that routine geodetic computations may be done by faster machine methods. Performance data from many sources are continuously assembled and classified for use in preparing practical instruction manuals for control survey work.

Section of Cartography.—Work on the International Map of the World on a scale of 1: 1,000,000 was continued by the Section of Cartography. Seven sheets were in progress—Austin (H–14), Mississippi Delta (H–15), Los Angeles (I–11), Savannah (I–17), Mt. Shasta (K–10), Lake Erie (K–17), and Cascade Range (L–10). At the end of the year two sheets were in course of publication—Hatteras (I–18) and Chicago (K–16).

Preparation of the transportation map for the Public Roads Administration was continued. Compiling, inking, lettering, and editing was in progress for the States of Louisiana, Nevada, Ohio, West Virginia, Alabama, and Indiana. Eight sheets in Virginia and the sheet for Washington and vicinity were transmitted for publication; 10 of the 33 sheets in Texas were published.

A complete revision of State base maps on a scale of 1: 500,000 was started during the fiscal year. Compiling, inking, and lettering is in progress on maps for the States of Wyoming, New Jersey, Massachusetts, Rhode Island, Connecticut, and Delaware.

The Columbia River Basin map was completed and printed.

Section of Inspection and Editing.—During the year 166 quadrangle maps were edited for publication, of which 137 were for multicolor photolithography and 29 for engraving; 150 quadrangle maps, 19 State maps, and 14 State index maps were prepared and edited for reprint editions; 100 maps and diagrams that had been prepared as illustrations for geologic reports were edited; and 345 proofs of all kinds were read. On June 30 maps in the process of reproduction included 54 for engraving and 72 for multicolor photolithography; maps being edited or awaiting editing included 29 maps for engraving and 17 for multicolor photolithography; and 256 maps remained on hand for preparation for reprinting.

Section of Photomapping.—The principal work of the Section of Photomapping is the production of topographic maps from aerial photographs by stereophotogrammetric methods and the production of planimetric maps and planimetric bases for topographic field surveys by both stereophotogrammetric and graphic methods.

Topographic maps of areas in the United States produced during the year by these methods covered approximately 9,396 square miles; planimetric and base maps covered an area of approximately 10,630 square miles. Topographic maps of foreign areas for the War Department, produced in manuscript form from aerial photographs, covered an area of approximately 9,522 square miles. In addition, Geological Survey personnel, working in cooperation with the Tennessee Valley Authority, either completed or supervised additional foreign mapping for the War Department in the amount of 2,482 square miles.

At the principal office of the section, in Arlington, Va., in addition to large production facilities, which are operating on a two-shift basis, here are also maintained a central laboratory for designing, testing, repairing, and adjusting all types of special optical and mechanical equipment utilized for stereophotogrammetric work and a photographic laboratory specializing on research and precision photography required for the other offices.

The Washington office maintains a general file of aerial photographs utilized in the work of the Geological Survey and of aerial photographic negatives that have been purchased under photographic contracts. Through this office contacts are maintained with other governmental agencies involved in aerial photographic work.

Map Information Office

During the fiscal year a great expansion of the activities and facilities of the Map Information Office was begun. This Office was established in 1919 under the Federal Board of Surveys and Maps with personnel and facilities of the Geological Survey. The Board was abolished in 1942 and its functions assigned to the Bureau of the Budget, at whose request the Map Information Office has since been maintained by the Geological Survey. During the war years this office was relatively dormant because of necessary restriction upon the dissemination of map information and other terrain data. Since the close of the war a greatly increasing volume of requests for map information has been evident, not only from our own map producing units but from other agencies and from the general public. It has therefore become necessary to completely reorganize our previous facilities for the dissemination of map information and considerably broaden the scope of service heretofore available. Several specialized units have been developed within the new Map Information Office for this purpose, namely, Topographic Maps, Aerial Photography, Map Control, General and Foreign Maps, and a service facility for the preparation of reports, exhibits, and index and progress maps.

During the 6 months that the Map Information Office has been functioning with additional personnel the number of visitors and the volume of inquiries, both by letter and telephone, have greatly increased, thus reflecting the attitude of the public to the advantages of such a service.

Topographic Maps.—The Topographic Map Unit is responsible for the research, assembly, evaluation, and maintenance for reference of all topographic data pertaining to the United States and its possessions. Various indexes showing the status of topographic mapping are maintained, for example, the map accompanying this report, which shows the areas of the United States covered by the topographic maps of the Geological Survey that are now considered adequate for general requirements.

Aerial Photography.—Records of the aerial photographic coverage available from all sources are maintained by the Aerial Photography Unit, and facilities are to be developed for film storage and the preparation of prints of Geological Survey photographs, to meet the increasing requests from other agencies and the general public.

Map Control.—The Map Control Unit is responsible for the assembly of data on all surveys considered usable for the control of map compilation by various processes. The maintenance of adequate descriptive data regarding control established by the Geological Survey and distribution of the data to other agencies and the general public is a function now being transferred to this unit, which will also prepare and publish State index maps showing the location of all control lines.

General and Foreign Maps.—The Unit for General and Foreign Maps conducts research for all general maps (other than topographic) of the United States and its possessions for the use of production units in planning and carrying out new mapping projects and for reference in meeting information requests of other agencies and the general public. Regarding foreign maps, only summary data are maintained—sufficient, however, to service general requests for information and the occasional foreign projects undertaken by the Geological Survey.

Exhibits and Special Reports.—During the fiscal year several exhibits were prepared at the request of the Library of Congress, technical societies, and scientific expositions. Permanent exhibits will be prepared during the coming year to meet increasing requests of this nature with a minimum of special preparatory work. Many requests by the press and technical publications for geographic information and for statements regarding the Survey's mapping activities were furnished, and demands of this nature are continuing to increase.

Field Surveys

Topographic mapping was carried on in 35 States. Cooperative projects were conducted with 17 States and with the Tennessee Valley Authority.

TABLE 1.—*Topographic mapping by the Geological Survey in the United States, Puerto Rico, and Hawaii, to June 30, 1946*

State	Area mapped during fiscal year 1946 for publication on standard scales, contour intervals from 1 to 50 feet (square miles)				Total area mapped to June 30, 1946 (square miles)	Percentage of total area of State mapped to June 30, 1946	Control, fiscal year 1946		
	Field scale		New survey	Resurvey			Spirit levels (miles)	Transit traverse (miles)	Triangulation stations established
	1 to 24,000 or larger	1 to 48,000							
Alabama	539		270	269	26, 348	51. 1	317	382	
Arizona	138	1, 415	1, 415	138	34, 936	30. 7	365		54
Arkansas		37	37		24, 667	46. 5		8	
California		425	187	238	132, 817	83. 7	580		100
Colorado	[1] 226		98	128	58, 363	56. 0	83	45	41
Connecticut					5, 009	100. 0			
Delaware					2, 057	100. 0			
District of Columbia					69	100. 0			
Florida					11, 949	20. 4			
Georgia	106	79		185	25, 202	42. 8	378	295	
Idaho	194	142	335	1	37, 964	45. 4	88		17
Illinois	12	1, 915	1, 927		47, 764	84. 7	326	343	
Indiana	565		565		8, 749	24. 1	574	355	
Iowa					14, 233	25. 3			
Kansas	10	377		387	65, 852	80. 0		169	
Kentucky	296		246	50	27, 805	68. 8		31	
Louisiana	337	8	316	29	18, 901	39. 0	252	187	
Maine		436		436	25, 977	78. 2			
Maryland					10, 577	100. 0	235	228	18
Massachusetts	284			284	8, 257	100. 0			
Michigan	397	628	725	300	17, 802	30. 6	224	94	
Minnesota	30		30		9, 572	11. 4	80	85	
Mississippi	13		13		9, 010	18. 9			
Missouri	261	1, 748	1, 165	844	63, 948	91. 8	15	160	
Montana	20	27	47		39, 788	27. 0	193	80	10
Nebraska	167	16	183		28, 408	36. 8	1, 053	456	31
Nevada		184	184		44, 165	40. 0	50		20
New Hampshire		70		70	9, 304	100. 0			
New Jersey					7, 836	100. 0			
New Mexico					36, 676	30. 1	498	77	64
New York	561	68		629	49, 576	100. 0			
North Carolina	45	46	91		19, 665	37. 3	402	176	
North Dakota	68	744	812		18, 147	25. 7	1, 268	1, 171	
Ohio					41, 222	100. 0		160	
Oklahoma	2		2		41, 901	59. 9	518	334	16
Oregon		319	319		36, 438	37. 6	71		17
Pennsylvania	398		398		43, 961	97. 0		35	14
Rhode Island					1, 214	100. 0			
South Carolina	368	261	629		16, 401	52. 8	19	63	
South Dakota					20, 750	26. 9	519	464	30
Tennessee	470			470	23, 998	56. 8			
Texas		659	659		93, 395	34. 9	814	406	38
Utah		44	44		20, 272	23. 9			
Vermont	6	124		130	9, 365	97. 5			
Virginia	91	590		681	38, 097	93. 3		54	
Washington		158	158		44, 561	65. 3	212		36
West Virginia					24, 181	100. 0			
Wisconsin		(2)			20, 348	36. 2	166	109	
Wyoming	42	309	351		36, 169	36. 9	100		
Total	5, 646	10, 829	11, 206	5, 269	1, 453, 666	48. 1	9, 400	5, 967	506
Hawaii					6, 435	100. 0			
Puerto Rico					3, 370	98. 8			

[1] Includes 182 square miles mapped on scale of 1:31,680.

[2] Plaimetric maps covering 1,117 square miles in Wisconsin, not included in total surveys, were compiled from aerial photographs with field examination.

The mapping of 56 15-minute quadrangles and 105 7½-minute quadrangles was completed, and mapping was in progress on 68 15-minute quadrangles and 109 7½-minute quadrangles at the end of the year. In addition, work on 336 quadrangles was progressing in some one of the steps prior to actual mapping.

For the Corps of Engineers, Army, the mapping of parts of four rivers was completed and mapping was in progress on three additional projects for flood control in several States. The mapping of Fort Knox, Ky., was completed for the War Department, and basic control accomplished at Fort Benning, Ga., Fort Bragg, N. C., Wright Field, Ohio, and Fort Ord, Calif.

At the request of the Bureau of Reclamation, mapping on a large scale was completed for the Canton project, Oklahoma, and the Englewood project, Oklahoma-Kansas; basic control was accomplished on the Mora River and Chico Creek projects, New Mexico, and an extensive survey begun in the Missouri River Valley for the study of water power, flood control, and irrigation in many States.

At the request of the National Park Service, large-scale mapping was completed of the home of Franklin D. Roosevelt National Historic Site and the Vanderbilt Mansion National Historic Site, Hyde Park, N. Y.

Culture revision of the Yosemite National Park in California was completed. The survey of Olympic National Park in the State of Washington was continued. For the development of a recreational area in Indiana, a survey was made of the Mississinewa River from the city of Marion to the Wabash River.

For use in the development of the Columbia River Basin, for power, flood control, and irrigation in many States, mapping was in progress on the Snake River in Idaho.

At the request of the Geologic Branch, a large-scale map of Gabbs and vicinity, Nev., was made for the study of magnesite deposits, and radar stations were established to control an airborne magnetometer survey in the Gulf of Mexico. The revision of all topographic maps in the San Joaquin Valley, Calif., was begun. A large-scale map of the Naval Oil Shale Reserve, Colo., was completed for the Navy Department.

Water Resources Branch

The need for information on our water resources is evidenced by the steadily increasing number of requests from Federal, State, county, and municipal authorities in all parts of the country for investigations of the availability and chemical quality of water. This information is essential to successful planning and construction of projects related to many purposes, including irrigation, inland navigation, power production, industrial installations, municipal supplies, and flood control, which involve the storage, control, or use of water, and therefore require continuous and up-to-date ecords concerning its fluctuations in quantity and quality, and its availability and utility. The needs arise from greatly increased use of water; rom shifting of population as a result of establishment of new industries in areas that were previously rural or thinly settled; from the expansion of existing industries; and from our needs for increased production of power and agricultural products. Programs of water investigations are accordingly being expanded in all sections of the country.

Normal growth in the use of water has been accelerated and the need for information concerning it intensified by new basin-development projects, patterned in concept but apparently not in organization somewhat after the Tennessee Valley Authority. The Missouri River Basin is now being developed for flood control, irrigation, navigation, and water power. Similar development programs for other basins, such as those of the Arkansas and Columbia Rivers, are expected to follow. Such projects rest primarily on the availability and use of water. They require, therefore, much more comprehensive investigations of the water resources of those basins than have heretofore been considered urgent.

Major development and reconversion projects involve the use of water in large quantities. Reliable information concerning the available supply must be available before such projects can be safely planned and satisfactorily executed. Water investigations by the Geological Survey precede and must be closely coordinated with the programs and projects of constructing and operating agencies. Realization of the need for coordination is demonstrated not only in connection with the trend toward basin development but also by the cooperative grants made by States and municipalities, which in 1946 aggregated more than $1,600,000, and by other Federal agencies, which provided to the Survey more than $1,300,000 for special water investigations made at their request.

The operation of hydraulic and industrial plants requires current information as to fluctuations in water supplies. As the limit of supply is approached or reached, the demand for reliable information increases and becomes more insistent. Although funds for financing the needed investigations have been increased in recent years they are yet inadequate to meet pressing needs.

Water investigations must be made locally because of the wide variations in quantity from place to place and because of the great fluctuations at any one place resulting from the vagaries of precipitation. The Survey's investigations of water have always been made chiefly from field offices, and the decentralization has become even more marked in recent years: in 1946 the work was conducted from more than 100 field offices, with one or more such offices in every State and in the Territory of Hawaii. This decentralization has resulted in a high degree of efficiency and economy of work and in better service to the public. Through the field offices close contacts are maintained with local Federal, State, and municipal officials, and the interests of cooperating agencies are served. The Survey's field offices are local sources of information as to available water resources, fluctuations in th ground water table, and fluctuating stage and discharge of surface stream

Funds aggregating more than $5,000,000 were available for water investigations in the fiscal year 1946. Of that amount about 41 percent wa appropriated by Congress, about 33 percent was contributed by States an municipalities, and about 26 percent was provided by other Federal agencie

Cooperation With States and Municipalities

States and municipalities provided about a third of the funds for th Survey's water investigations during the fiscal year 1946. The amounts contributed for cooperation in each States are summarized below:

State	Total offered	State	Total offered
Alabama	$18, 315	New Hampshire	$10, 114
Arizona	67, 899	New Jersey	24, 950
Arkansas	23, 500	New Mexico	51, 845
California	98, 149	New York	117, 119
Colorado	42, 500	North Carolina	29, 094
Connecticut	11, 550	North Dakota	29, 184
Delaware	2, 000	Ohio	56, 691
Florida	59, 526	Oklahoma	26, 296
Georgia	21, 500	Oregon	29, 802
Idaho	29, 250	Pennsylvania	55, 751
Illinois	34, 092	Rhode Island	4, 700
Indiana	41, 212	South Carolina	14, 633
Iowa	32, 747	South Dakota	8, 480
Kansas	34, 667	Tennessee	31, 657
Kentucky	27, 329	Texas	93, 137
Louisiana	31, 079	Utah	39, 167
Maine	7, 500	Vermont	6, 260
Maryland	30, 750	Virginia	38, 319
Massachusetts	17, 288	Washington	67, 981
Michigan	43, 861	West Virginia	14, 550
Minnesota	19, 840	Wisconsin	16, 039
Mississippi	14, 981	Wyoming	32, 009
Missouri	20, 561	Hawaii	58, 468
Montana	25, 231	Puerto Rico	2, 700
Nebraska	34, 988		
Nevada	26, 883		1, 676, 144

Activities Carried on for Other Federal Agencies

Other Federal agencies provided in 1946 more than $1,300,000 for water resources investigations that could not be financed by appropriated funds of the Geological Survey or included in cooperative programs. These agencies are the Bureau of Reclamation, Office of Land Utilization, Office of Indian Affairs, Fish and Wildlife Service, Southwestern Power Administration, Bonneville Power Administration, and National Park Service, Department of Interior; Office of the Chief of Engineers, War Department; Navy Department; State Department; Soil Conservation Service, Departent of Agriculture; Weather Bureau, Department of Commerce; Tennes-e Valley Authority; Federal Power Commission; Federal Works Agency; ubber Reserve Corporation; and Foreign Economic Administration.

Operational Activities

The operations of the Water Resources Branch have been conducted by our administrative units—Division of Surface Water, Division of Ground Water, Division of Quality of Water, and Division of Water Utilization.

Surface Water.—Records of stage, quality, and availability of surface waters are collected through 56 field offices at 5,807 gaging stations dis-ributed throughout every State and the Territory of Hawaii, in cooperation with 172 State and municipal agencies and with many Federal agencies.

Ground Water.—The investigations of ground water relate to water from which wells and springs are supplied. They are conducted through 36 eld offices, in nearly every State and Hawaii, in cooperation with 72 State nd municipal agencies and with several Federal agencies. Periodic measurements of water levels or artesian pressure were made at about 7,000 ob-ervation wells.

Quality of Water.—Determinations of quality were made of 2,124 samples of water in the laboratory in Washington, D. C., and of 5,635 samples n laboratories in Albuquerque, N. Mex., Austin, Tex., Fayetteville, Ark., Raleigh, N. C., and Charlottesville, Va. Cooperative studies of the chemical character of surface waters were in progress in Pennsylvania, Virginia, Florida, Georgia, North Carolina, Louisiana, Arkansas, Texas, and New Mexico. Samples were analyzed for cooperative studies of ground water n those and other States.

Utilization of Water.—Water utilization studies were made in the Wash-ngton office and 3 field offices, financed in part by other Federal agencies.

The important relations of the chemical quality of water to its utility for many purposes have become increasingly apparent in recent years. The great increase in the industrial pollution of water caused by war activities in many regions widely scattered throughout the country and the lag during the war in the treatment of waters to improve their chemical quality have served to emphasize the importance of quality in connection with programs of development and operation. There has been, therefore, a considerable expansion of the Survey's investigational programs related to quality of water and of the equipment of chemical laboratories for the economical conduct of those programs. Besides the central laboratory in Washington, D. C., the Survey now operates chemical laboratories for the analysis of water in Charlottesville, Va., Raleigh, N. C., Lincoln, Nebr., Fayetteville, Ark., Austin, Tex., and Albuquerque, N. Mex. A laboratory is to be installed at Salt Lake City, Utah, in 1947.

Sediment carried by rivers is deposited in reservoirs, canals, and navigation channels. Determinations of its quantity is important, therefore, in connection with the planning of projects for the storage and use of water, the design and construction of hydraulic structures, and the operation of hydraulic works. Much more attention than formerly is now paid to the systematic measurement of the sediment content of those rivers that carry considerable quantities of matter in suspension. The Survey has served in an interagency committee on the design of an improved sediment sampler for use by all agencies that measure the sediment content of flowing water, to the end that greater accuracy may be attained and that the results may be reasonably consistent. In 1946, the Survey operated laboratories for analyzing sediment at Albuquerque, N. Mex., Lincoln, Nebr., Worland, Wyo., and Dickinson, N. Dak.

Missouri River Basin.—The coordinated projects of the Bureau of Reclamation and the Office of the Chief of Engineers for the basin-wide development of the Missouri River Basin have led to unusual expansion of water investigations in that basin. The investigational programs, conducted generally in cooperation with States and municipalities, have been supplemented during 1946 by the installation of 96 gaging stations; by expansions of ground-water studies to cover areas in 19 localities where problems related to ground water levels or to changes in those levels resulting from reservoir construction or irrigation may be expected; by measurements of the sediment content of surface waters at 23 stations; by systematic records of the chemical quality of the waters of 4 rivers and by miscellaneous records of 40 other rivers; and by hydrologic and utilization studies related to the proposed plans of development. The information obtained by these investigations is furnished to the action agencies currently or periodically as may be desired.

Interstate and International Agreements

Interstate compacts for equitable division between States of waters of interstate streams, which require the Geological Survey to establish and operate gaging stations, are now in effect on the Colorado River (Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada, California); the Belle Fourche (Wyoming, South Dakota), the Republican River (Nebraska, Kansas), and the Rio Grande (Colorado, New Mexico, Texas). To these are to be added in 1947 similar activities on Costilla Creek (Colorado, New Mexico).

International problems related to water are increasing. The current development activities in the Missouri River Basin, the proposed development in the Columbia River Basin, and the application of the treaty effective November 8, 1945, with Mexico in relation to the division between the United States and Mexico of the waters of the Rio Grande and of the Colorado and Tia Juana Rivers are increasing the problems related to water arising on both the northern and southern boundaries, in which the

State Department is involved and for which that Department transfers money to the Geological Survey for special investigations that are needed.

Reports on Investigations

The results of the varied hydrologic and hydraulic studies and computations made by the Water Resources Branch are made available for public inspection as soon as practicable by placing manuscript copies of observations, measurements, and analyses in the open files of the district offices concerned, as soon as they have been approved.

The published work of the Water Resources Branch during the fiscal year 1946 consisted of 21 Water-Supply Papers; 14 issues of the Water Resources Review, a mimeographed monthly summary of stream flow and ground-water conditions in the United States and Canada; 9 mimeographed reports, 8 reports published by cooperating State agencies, and a large number of short technical papers in professional journals.

Conservation Branch

The Conservation Branch, under delegation of authority from the Director, classifies the public lands of the United States as to mineral and water resources and supervises operations on public, Indian and naval petroleum reserve land leases, permits, and licenses, for the development of these vital natural resources. The work requires the maintenance of a headquarters staff in Washington and a field staff competent to solve problems of geology, engineering, economics, and administration in complying with legislation enacted by the Congress, which contemplates that this Nation's resources shall be developed and produced by private enterprise in accordance with approved methods. The activities include field investigations, the preparation of maps and reports dealing with water power, fuels, minerals, and chemicals essential to the postwar economy of the United States, and "on-site" supervision of mining and drilling operations essential to the production thereof.

Classification of Lands

Mineral Classification.—In continued response to war-engendered demand for additional supplies of mineral fuels, fertilizers, and basic chemicals from the public domain, most phases of the service rendered by the Mineral Classification Division in the administration of public and semipublic lands were maintained at an accelerated pace during 1946.

In all, about 12,000 cases were acted on during the year, a 9 percent decrease from 1945 that is attributable in no sense to diminished demand for classification service but wholly to insufficient personnel. Initial or revised definitions of the known geologic structure of 71 producing oil or gas fields were prepared and promulgated; geologic appraisal was mad of 90 unit-plan or participating-area submissions; some 58 special report were rendered to the General Land Office on new discoveries of oil or ga on or adjacent to Federal lands, including 22 applications for the royalt benefits of the act approved December 24, 1942 (56 Stat. 1080), for th discovery of new oil and gas fields or deposits during the war emergency and, for a variety of extradepartmental agencies concerned with the disposal of acquired lands of the United States, determinations were mad of the potentialities for fissionable materials of some 970 land parcels i various States, Territories, and possessions, pursuant to Executive Orde No. 9701 of March 4, 1946, and to authority for such determinations delegated to the Geological Survey by Department Order 2188 of April 19, 1946.

From field headquarters in Colorado, Wyoming, Montana, Utah, and California, division geologists made numerous "spot" investigations precedent to public-land and mineral-leasing law adminstraton, and as useful byproducts of its field studies, effected the publication of new or revised maps of the areal geology and structure of the Garland-Byron area and Little Buffalo Basin area, Big Horn and Park Counties, Wyo., and the Arden area, Clark County, Nev.

Water and Power Classification.—The Water and Power Division obtains basic information concerning the water-power resources and storage possibilities of Federal lands. During 1946 the work was confined largely to projects proposed for early development. Work in the Missouri River Valley was greatly expanded to meet the need of the Bureau of Reclamation and the Corps of Engineers, United States Army, for maps to use in planning future projects in that valley.

Topographic surveys were made of 3 dam sites and 137 linear miles of stream valley, of which 64 miles is in the Missouri River Basin. In cooperation with the Water Resources Branch, supervision of construction and operaton was given to 163 power projects under license from the Federal Power Commission, to 230 such projects under permit or grant from the Department of the Interior, and to 161 in cooperation with the Office of Indian Affairs.

Office activity resulted in the addition of 91,240 acres to power-site reserves and the elimination of 5,075 acres, increasing the outstanding reserves in 22 States and Alaska to a net total of 6,860,462 acres; in the preparation for publication of maps of 300 miles of river channel; in final action involving hydraulic determination on 307 cases received for report from departmental sources and the Federal Power Commission and in water-power classification on 2,831 cases, which also involved mineral classification.

Investigations and studies were in progress involving the power and storage possibilities of 36 rivers. Reservoir-site reserves in nine States remain unchanged at 137,172 acres.

A regional office in charge of a district engineer was reestablished during the year at Sacramento, Calif.

Mineral Lease Supervision

Mine supervision.—The Mining Division administers the mining operating and safety regulations under the respective mineral leasing acts providing for the exploration, development, and mining of mineral deposits on public domain and Indian lands in the United States and Alaska, and in accordance therewith supervises mine operations, including prospecting, development, and production of coal, potassium, phosphate, sodium, silica sand, oil shale, and sulfur on public lands; of gold, silver, mercury, vanadium, and quartz on various land grants; and of all minerals, except oil and gas, on segregated, restricted, allotted, and tribal Indian lands. The production of minerals from public and Indian lands continued at war-time rates to meet the industrial and civil needs for reconversion to a peace-time economy. The total mineral output during the year was valued at more than $66,000,000.

The Division, in the performance of its functions, provides technical service and assistance to the Office of the Secretary of the Interior, the Office of Indian Affairs, and the Bureau of Land Management in the administration of mineral leases, permits, and licenses, and related problems. It also serves as consultant to the Department of Agriculture on mining permits and leases under the jurisdiction of that Department and supervises production of minerals from public lands by the Metals Reserve Company and the War Assets Administration, successor to the Defense Plant Corporation. Under supervision as of June 30, 1946, were 555 properties on public-domain land under lease, permit, and license; 235 properties on Indian land under lease or mining permit, in 14 States and Alaska; and 3 secretarial authorizations in 2 States.

The mining Division cooperated with the Departments of War, Justice, and Agriculture, other Bureaus of the Department of the Interior, the War Production Board, the Reconstruction Finance Corporation, and the War Assets Administration on the administration of mineral leases and interrelated problems and is designated as an agency for determining the relative merits of applications for access roads to be built by the Public Roads Administration of the Federal Works Agency and to provide the Smaller War Plants Corporation with factual data on mining properties on the public domain for use in consideration of loan applications.

The production of potassium continued to increase under the impetus of the demand for food production both at home and abroad. More than 99 percent of the national output is produced by four Government lessees, three in New Mexico, one of which operates on public and State land, and one in California, which operates on public and fee land. Prospect drilling in advance of mine development in New Mexico during the year has added substantially to known reserves. Drilling by the International Mineral & Chemical Co. disclosed an entirely new area southwest of its present operations potentially as valuable as the one on which it is now operating. The only other known undeveloped commercial deposits of potash in New Mexico is contained in a Government reserve created by Executive Order No. 6797 of July 27, 1934.

Phosphate production also reflected the demand for fertilizer materials to increase food production. The output from public domain increased 70 percent over the previous year, and further increase is anticipated as phosphate leases recently issued get into production. The suspension of action on the issuance of phosphate leases under Departmental Order No. 1294 of July 2, 1938, except in particularly meritorious cases, continues in force.

Most of the output of sodium products from public domain is from Searles Lake, Calif. Refined salts from that source include potassium, borax, soda ash, salt-cake, bromine, burkite, and sodium lithium phosphate. During the war these chemical products were utilized in the manufacture of war materials, such as percussion caps, bombs, flares, shells, smokeless power, synthetic rubber, armor plate, range finders, bomb sights, and fire-control apparatus. Sodium products are also used in the production of glass, enamel ware, porcelain, soaps, medicines, ferrous alloys, kraft paper, and flame-resisting paints and fertilizer, water treatment, cleaners, and numerous other purposes for which consumption is expected to continue at wartime rates.

Production of lead and zinc from Quapaw Indian lands in Oklahoma amounted to about 7 percent of the national output, considerable less than prewar production. To an appreciable extent the decrease can be attributed to the over-all labor shortage, but the main factor was a continuing depletion of high- and medium-grade ore reserves. Study of the ore reserves on Quapaw Indian land initiated in 1944 were continued as an aid in maintaining production and to obtain information as to the probable reserves of low-grade ore that may be amenable to mining by large-scale mechanized operation.

Other minerals produced from Indian land included coal, tungsten, manganese, vanadium, uranium, limestone, gypsum, and sand and gravel.

Oil and gas supervision.—The Oil and Gas Leasing Division supervises operations for the discovery and production of petroleum, natural gas, gasoline, and butane occurring in public lands of the United States, in naval petroleum reserves, and in all Indian lands subject to Departmental jurisdiction, both tribal and allotted, except those of the Osage Nation, in Oklahoma. During the year these duties were accomplished through 18 field offices and suboffices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

Owing to the necessity of absorbing increased costs of Public Law No. 106 there were numerous separations of personnel, which vitally affected rogrammed work on secondary-recovery studies. The four special study roups, which were engaged in this timely investigation in aid of secondary covery operations and other engineering practices necessary to conservaion and maximum ultimate recovery of petroleum from public and Indian nd leases, were necessarily inoperative during a major portion of the ear, resulting in the issuance of but one published report and the suspenon of work on seven others in various stages of completion.

On public lands, 8,750 oil and gas properties were under supervision at he end of the fiscal year, aggregating 6,034,397 acres in 20 States and laska, an increase of 24 percent in the number of properties and nearly 1 percent in the acreage under supervision at the close of the previous iscal year.

Drilling on public lands during the year included the spudding of 496 wells and the completion of 550 wells, 386 of which were productive of oil and gas and 164 of which were barren. In all, 12,124 public-land wells, ncluding 6,589 capable of oil and gas production, were under supervision on June 30, 1946. The production from petroleum deposits of the public lands during 1946 was somewhat more than in 1945.

Activities toward unitization of oil and gas operations involving Federal land were reflected in an increase of 2 in the number of new unit plans approved during the year, the total being 24; 69 unit plans were terminated, leaving 131 approved plans covering 1,722,022 acres outstanding on June 30, 1946. Production under approved unit agreements constituted about 54 percent of the petroleum obtained from public lands during the year, 65 percent of the natural gas, and 75 percent of the gasoline and butane. In addition 2 Indian-land unit agreements covering a gross area of 36,710 acres were in effect during the year.

On Indian lands the work of oil and gas lease supervision involved 4,931 leaseholds in 10 States, containing at the end of the year a total of 7,525 wells, 4,042 of which were productive of oil or gas and 163 of which had been completed during the year.

On behalf of the Navy Department supervision was continued over operations for the production of oil, gas, gasoline, and butane from 21 properties under lease in Naval Petroleum Reserves Nos. 1 and 2 in California. Production from 286 active wells on this reserve aggregated 3,918,600 barrels of petroleum, 3,890,000,000 cubic feet of natural gas, and 9,313,000 gallons of natural gasoline and butane, having an aggregate royalty value of $727,328.

On War Department lands in the Rio Vista gas field the work included the consideration and approval of a number of the revisions in participating percentages for these lands and the computation of royalties due the United States on the gas production allocated to the lands in the amount of 4,397,930,000 cubic feet with a royalty value of $190,600.

Work on Publications

Texts.—During the year, 59 publications were issued, as follows: Professional Paper 205–B; Bulletins 943–C, 945–E, 946–A, B, C, D, E, 947–A, 949; Water-Supply Papers 889–F, 965, 967–A, B, C, 970, 971, 972, 973, 975, 976, 982, 987, 990, 991, 1004, 1007, 1009, 1010, 1011, and 1014; Geologic Atlas of the United States, Folio 227; Monthly list of new publications, Lists 448–459; and 15 index circulars. These reports cover 6,940 printed pages. Work by the editors included the following: 4,602 pages of manuscript edited and prepared for printing; 516 galley proofs and 2,655 page proofs revised and returned; indexes prepared for 12 publications, covering 923 pages, and consisting of 3,777 index entries. Copy edited in preparation for mimeographing included 15 press releases, consisting of 25 pages, and 72 pages of miscellaneous material.

Illustrations.—Drawings and photographs numbering 578 for 29 reports were transmitted for printing by the customary processes—chromolithography, photolithography, halftone, zinc etching, collotype, and offset. In addition 15 maps and sections showing the results of cooperative investigations in the American Republics were prepared for preliminary release. Seven hundred sixty-nine proofs and twenty-four edition prints were examined.

Geologic maps.—During the year, 482 geologic maps, charts, diagrams, and other illustrations were prepared by the Section of Geologic Cartography for black-and-white and multicolor reproduction. Work on Geologic Folio 228, Hollidaysburg-Huntingdon, Pa., was completed, and the folio was delivered in June. The geologic map of Idaho, to be printed in 16 colors, was sent to the Division of Map Reproduction, and the geologic map of Washington and vicinity is ready to be transmitted. Of the maps in the Missouri Basin series, 6 were printed, 3 others were completed, and 4 are now being drafted. Other geologic maps published or in various stages of preparation are colored maps of Zion Monument and Iron County, Utah; a black-and-white map of the State of Utah; a colored map showing chromite deposits of Del Norte County, Calif., published by the State; and 9 quadrangles of the Coast Ranges in California, to be published by the Geological Society of America.

Because of the development of the new cellophane stick-on patterns prepared from the Geological Survey's own geologic pattern plates, color plates for all but the most complicated geologic maps can now be prepared by sticking on the patterns. Publication is thereby greatly expedited.

In addition to editing the maps and other illustrations prepared by the Section of Geologic Cartography, the Geologic Map Editor critically reviewed 136 maps and figures prepared in the Section of Illustrations for Professional Papers and Bulletins; 26 maps prepared for Water-Supply Papers; 70 maps and figures drafted in the field and section offices for outside publication; 51 maps and figures planned for Survey publication but ot yet drafted; and 27 mineral resources maps to be issued jointly by the Geological Survey and the Bureau of Mines.

During the year, plans were completed for issuing a new series of multicolor geologic quadrangle maps. The explanations on these maps are to e expanded sufficiently to describe the rock formations, and for some maps brief explanatory text will be printed on the same sheet. In addition to he regular geologic maps, this series will include glacial geology maps, engineering geology maps, and other special maps.

Map Reproduction.—During the year the Division of Map Reproduction printed 1 geologic folio, 59 newly engraved topographic maps, 143 multicolor topographic maps, 13 planimetric maps, 51 preliminary geologic maps, and 6 special maps, making a total of 273 new maps printed and delivered. Reprint editions of 292 engraved topographic maps, 7 multicolor maps, and 22 photolithographed State geologic maps and planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 594 different editions, amounting to 1,712,610 copies, were delivered.

A large amount of work was done for 70 other units of the Government, ncluding branches of the Geological Survey and States; the charges for it amounted to about $160,000, for which reimbursement was made to the appropriation for engraving and printing geologic and topographic maps. 90 transfer impressions and velox prints were made during the year, and the amount turned over to miscellaneous receipts was $777.32.

The total number of copies of topographic maps and contract and miscellaneous work of all kinds printed and delivered was 4,014,657.

The photographic laboratory made 7,400 negatives, 30,840 prints, 3,366 photolith press plates, 102 intaglio etchings, and 7 celluloid transfers and mounted 632 prints.

Distribution.—The Division of Distribution received during the year a total of 722 publications, comprising 36 new book reports and pamphlets and 3 reprints; 51 preliminary maps and charts in the series of strategic minerals investigations; 222 new or revised topographic and other maps (10 of which were first published as preliminary editions); 2 Tennessee Valley Authority maps with contours; 408 reprinted maps (topographic, advance sheets, and planimetric); and 1 new geologic folio (No. 227). The total units received numbered 56,720 books and pamphlets (including reprints), 56,765 copies of revised index maps, 1,656,185 topographic and other maps, and 4,540 geologic folios, a grand total of 1,774,210.

The division distributed 66,607 books and pamphlets, 650 geologic folios, and 1,154,793 maps, a grand total of 1,222,050, of which 580 folios and 991,659 maps were sold.

The net proceeds from sales were $69,016.69 for maps and $192.25 for geologic folios. In addition $11,007.75 was repaid by other Government agencies for maps or folios furnished. The total net receipts, therefore, were $80,216.69. Since the cessation of hostilities the general public appears to be more map conscious. Local sale of maps to private individuals jumped from $3,406.26 to $5,747.09, which meant rendering service t nearly 6,000 people. The division handled 46,583 letters, an increase o 11,272.

Library

The end of hostilities, with the resulting change in the direction o activities of the Geological Survey, is reflected in the work of the library The work of the Military Geology Unit, which required the major part of the time of the library staff during the war, has continued, but at a diminishing rate; work in the domestic field has increased. More than 15,000 books, pamphlets, and maps were loaned to Survey personnel for use outside the library, and reading room circulation was over 36,000. Interlibrary loan activity declined but was still heavy; 3,022 books were loaned to other libraries, and 661 books were borrowed. Total circulation was 67,720.

New books, pamphlets, periodicals, and serial parts received numbered 12,037; new maps and charts, 721. Still unable to buy much from abroad, the library spent a considerable part of its book fund for the year in building up its reference collection on physics, chemistry, mathematics, and electronics, to supply new material needed in connection with the Survey's expanded work in those fields.

Foreign exchanges material has begun to arrive from countries formerly cut off from communication, and the Geological Survey has resumed the sending of its publications to libraries sharing in the exchange. The librarian has participated in conferences by Federal libraries interested in the acquisition of foreign texts and maps and has cooperated in the formulation of plans, some of which have been put into operation.

The Bibliography of North American Geology, 1942 and 1943, published as Bulletin 949, was delivered, and the compilation of the succeeding volume covering 1944 and 1945 was completed.

Field Equipment

The Division of Field Equipment has produced relatively few new items of equipment during the past year, for the reason that the essential maintenance and repair work of the Bureau has absorbed practically all of its production capacity, and work on new developments was necessarily curtailed. The only new item of interest consisted of a stereoscope containing only a single prism in the optics thereof. Geologists have found that this stereoscope is particularly convenient for viewing stereoscopically 9- by 9-inch aerial photographs in the field. It consists of a pair of hinged covers 10 inches square that can be opened to an angle of 120° only. As the covers are opened, an adjustable rod bearing the prism rises to a position midway between the two covers and about 9 inches from the center of each photograph. The stereoscopic pair of photographs are attached by means of suitable clips to the inside of the covers—one photograph to ch cover. The arrangement is such that when the observer places his t eye over the prism and looks down, the photograph on the cover imediately below is observed with his right eye, while that on the opposite ver is observed with his left eye through the prism. The field of this ecial prism is so large that the entire usable portion of the photographs n be seen stereoscopically without readjusting the photographs. In its resent form no magnification is provided. Because the lower photograph completely free from obstructions, details and important points can be asily selected and marked thereon. Another convenience is that the device rovides a light, compact, and portable carrying case for the photographs. ersons afflicted with certain eye defects that have prevented them in the ast from using ordinary stereoscopes will find it possible to use stereoscopes f this type without difficulty.

Funds

During the fiscal year 1946 there was available for obligation under the irection of the Geological Survey a total of $15,106,774. Of this amount 7,407,605 was appropriated directly to the Geological Survey, and $7,699,-69 was made available by other Federal agencies, and by States and their olitical subdivisions. In addition, $13,000 was allotted from the appropriation for contingent expenses of the Department of the Interior for niscellaneous supplies.

Funds available to the Geological Survey in 1946 from all sources

Administrative salaries and expenses:		
Interior Department Appropriation Act	$218, 560	
Supplemental appropriation	27, 750	
		$246, 310
Topographic surveys:		
Interior Department Appropriation Act	2, 146, 560	
Supplemental appropriations	135, 540	
States, counties, and municipalities	559, 042	
Bureau of Reclamation	677, 000	
Public Roads Administration	45, 524	
Navy Department	16, 063	
Tennessee Valley Authority	75, 000	
War Department	1, 363, 592	
Miscellaneous repay	68, 033	
		5, 086, 354
Geologic surveys:		
Interior Department Appropriation Act	1, 187, 500	
Supplemental appropriation	800	
States, counties, and municipalities	86, 100	
Bureau of Reclamation	265, 000	
Navy Department	13, 900	
War Department	555, 102	
Republic of Chile	11, 102	
Miscellaneous repay	19, 398	
		2, 138, 902

Funds available to the Geological Survey in 1946 from all sources—Cor

Strategic and critical minerals:		
Interior Department Appropriation Act	$325,000	
States, counties, and municipalities	14,000	
State eta sh cm cmfwyp cmfwyp	129,859	
		$468,85
Mineral resources of Alaska:		
Interior Department Appropriation Act	157,500	
Navy Department	117,890	
War Department	75,000	
		350,39
Gaging streams:		
Interior Department Appropriation Act	1,787,200	
Supplemental appropriation	321,100	
States, counties, and municipalities	1,676,144	
Permittees and licensees of Federal Power Commission	41,580	
Department of the Interior:		
Bureau of Reclamation	520,266	
Office of Indian Affairs	6,145	
Office of Land Utilization	17,995	
State Department	87,221	
Tennessee Valley Authority	61,000	
War Department	609,920	
Miscellaneous repay	21,606	
		5,150,177
Classification of lands:		
Interior Department Appropriation Act	213,400	
Supplemental appropriation	800	
States, counties, and municipalities	2,500	
Bureau of Reclamation	278,797	
		495,497
Printing and binding: Interior Department Appropriation Act		101,500
Preparation of illustrations:		
Interior Department Appropriation Act	29,230	
Supplemental appropriation	2,110	
		31,340
Engraving and printing geologic and topographic maps:		
Interior Department Appropriation Act	263,210	
Miscellaneous repay	160,500	
		423,710
Mineral leasing:		
Interior Department Appropriation Act	484,100	
Office of Indian Affairs	99,200	
Navy Department	20,000	
Miscellaneous repay	4,690	
		607,990
Arkansas River Compact: First Deficiency Appropriation Act		2,371
Payments from proceeds of sale of water, special account		3,374
Total funds available		15,106,774

Solid Fuels Administration for War

DAN H. WHEELER, *Deputy Administrator*

THE Solid Fuels Administration for War opened the 1945–46 fiscal year faced with the job of providing enough coal and coke to hasten he defeat of Japan. Solid fuels, at that time, were still short even though Germany had been defeated.

After victory over Japan, coal requirements receded slightly. Then folowed a wave of strikes. Production losses became serious. Before the end of the year the Nation's coal supply was cut by strikes about 30,000,000 tons. Special-purpose coals were critically short.

When relief came to the national market, pressure was brought for more export coal. The liberated nations of Europe had to be supplied. SFAW was called upon for quantities of lower grade coals for this need. At the same time scarce and higher grade coals had to be held from export.

Late in autumn, with the resumption of mining and increased production, SFAW began to revoke controls over distribution. This was done as fast as possible.

Plans were made for liquidation by the end of the fiscal year. However, because of the terrific loss of coal caused by strikes in the spring of 1946, the industry itself requested that SFAW be continued and this was effected. It went into action again as prospects for the 1946–47 winter were not too bright.

Between the Surrenders

The end of hostilities in Europe found the United States with a serious deficiency in high-grade coals, a continuing manpower shortage in the mines, handicapped for lack of equipment and replacement parts for machinery, and the consequent continued need for regulation of distribution, to speed the fall of Japan and prevent hardship to consumers.

Shortage of manpower, the most serious wartime problem of the coal industry, was not relieved for many months. SFAW continued efforts to recruit labor and to have miners deferred by Selective Service. Moreover, many miners had gone to other war industries paying higher wages, and strikes further curtailed production. SFAW assisted in wage negotiations between the operators and the United Mine Workers of America, and took over the mines until wage contracts had been signed. At times, insufficient supplies of meat caused dissatisfaction among the miners, resultin in sporadic strikes and high absenteeism. In some areas railway coal car continued in short supply.

In June 1945, 260 bituminous coal mines were returned by SFAW t their owners. Included were two properties of the Jewell Ridge Coal Corporation at Tazewell, Va., which had been in Government possession sinc November 1, 1943, due to failure of miners and operators to agree to th terms of the national bituminous wage agreement, and pending litigatio over portal-to-portal pay. After the United States Supreme Court ha ruled in the case that travel time is work time, the company signed th 1945 contract and the two mines were released. Three soft coal mine of the Carter Coal Co. at Coalwood and Caretta, W. Va., were retained i Government possession until March 28, 1946, because operators and workers had no contract. Termination of possession of the anthracit mines, taken over May 4, occurred on June 23, 1945.

At the commencement of the fiscal year, SFAW warned the Nation that a recent survey indicated requirements for the fuel year exceeded anticipated production by about 37,000,000 tons, of which 25,000,000 tons were bituminous coals needed by the industries. It was predicted also that coke would be in short supply as a home-heating fuel because of heavy demands by the steel plants.

During the summer SFAW, aided by the industry, conducted a conservation campaign. An envelope-stuffer entitled "All fuel is Scarce—Warns United States Government" was issued late in June. This was followed later by a circular entitled "Prepare for Winter," which emphasized winterproofing of houses by installation of storm doors, caulking, insulation, and the application of other heat conservation devices. Fuel conservation directors of 25 States were urged to launch local drives.

After the fall of Germany, reporting provisions of the regulations were modified. Lignite distribution was released from control. However, rice anthracite (Buckwheat No. 2) became scarce and was included with the larger sizes in a 90 percent limitation on retail deliveries, based on the consumer's normal annual burn. Until mid-August, summer deliveries of anthracite and byproduct coke were limited to 50 percent of annual quotas. Suppliers were required to meet their full commitments of coal for the Army, Navy, Maritime Commission, and Veterans' Administration. Overseas shipments of American-mined coals were prohibited without specific approval from SFAW. Early in September commitments of coal moving to industrial consumers via the Great Lakes were curtailed 5 percent.

Autumn Strikes Retard Recovery

Following the surrender of Japan, restrictions on deliveries by retail dealers were removed. Control of distribution was confined to the wholesale level. It was felt that shortage of preferred domestic fuels could now e relieved by the increased supplies of usable lower grade coals. In September, with the Lakes navigation season nearing an end, preference in shipnents of high grade coal to part of that region was required, to make up or early Lakes season deficiencies.

During the summer a series of strikes caused an estimated production oss of approximately 8,000,000 tons of bituminous coal, and about 3,600,000 ons of anthracite. On September 21 a widespread supervisory strike began n the eastern bituminous districts. It continued until October 17, with an stimated loss of 15,000,000 tons. The Government did not take over the nines, but during the strike SFAW issued emergency restrictions on shipnents of coal produced in four major eastern mining districts, coal being eleased only to the most essential users. As the supply for the Great Lakes rea was threatened, shipments by the upper Lakes dock operators were restricted to essential consumers.

Wartime Controls Relax

With the end of the supervisory strike, production gradually rose to a high level. Western-mined coal being in good supply, SFAW closed five of its western field offices, but retained offices in St. Louis and Minneapolis. Reporting requirements for mines west of the Mississippi River were removed. Emergency strike restrictions were lifted, and four orders of preference was set up for shipments of scarce eastern-mined soft coals: (1) to part of the Great Lakes area; (2) shipments of special purpose coals; (3) to retail dealers, and (4) to the remainder of the Lakes area. Most of the wartime controls over anthracite and coke were canceled, but retail dealers were directed to distribute their available supplies equitably. As domestic consumers could hardly hope to obtain their full supply of better grades, they were urged to make up the deficiency with inferior grades of solid fuels.

Supply to the upper Great Lakes continued behind schedule, so movement of coal to that area was accelerated while shipments of certain southern Appalachian coals to the lower Lakes ports were prohibited until the close of the navigation season, to be made up later by rail. Industrial stockpiling of district No. 8 coal, produced in Virginia, southern West Virginia, eastern Kentucky and northeastern Tennessee, was placed under strict control during November, in order to increase the supply for the retail trade and for industries with very low reserves. The restriction did not apply to Lakes shipments.

Fortunately navigation continued on the Great Lakes until December 1. After that date a different order of preference was established to make provision for the changed pattern of distribution, as follows: (1) Special purpose coal; (2) retail dealers' quotas; (3) additional shipments to the retail trade; (4) permission for a 60-days' stockpile supply, except of scarce southern Appalachian coals, and (5) a stock limitation table for those coals.

Any surpluses of southern Appalachian coals, after commitments had bee met by producers, were reported to SFAW, which then directed their dis tribution. Heavy seasonal shipments to the Great Lakes area had left th Southeast short of coal for the winter, and SFAW now directed coal int that area to make up deficient quotas.

By the first of the year, coal produced in the Midwestern States was i short supply, and shipments to industrial consumers having more than 2 days stock were reduced in order to provide more coal for retail yards an the harder-pressed industrial consumers. Commercial dock operators o the Great Lakes were required to schedule their shipments to retail dealer as a means of detecting surpluses which could be diverted to communitie in acute need of fuel. Early in February, 1946, shipments of domesti soft coal to army camps were stopped for the remainder of the month, a they appeared to have sufficient supply, and the coal saved was diverted t the retail trade.

In February, with the liquidation of SFAW in mind, the agency announced that during the next fuel year, beginning April 1, producers, distributors and consumers would be free to make their own agreements for fuel purchases. At that time it was contemplated that SFAW would exercise until June 30 only emergency controls and a limited supervision of exports. Reporting to SFAW, however, was to be continued.

On March 20, "surplus" coal was permitted to move via the Great Lakes without restriction, in anticipation of an early spring. At the end of the coal year, March 31, other restrictions on Lakes movement were revoked along with certain other orders. Regulations covering special coal and dealer receipts of Utah coal expired automatically and were not reissued. Regulations remaining in effect at the beginning of the new fuel year were those empowering SFAW to issue specific directions providing for the distribution of solid fuels, to supervise exports, and to subject solid fuels in transit to reconsignment, diversion, or rerouting in emergency. Orders which called for certain reports were retained, as were those establishing industry advisory committees.

1946 Strike Revives Need for SFAW

Immediately after the issuance of the order which revoked many of the controls, a threatened strike of bituminous coal miners called forth two emergency orders, one freezing on mine track the equivalent of one full day's production for direction to avert crises, and the other limiting deliveries by retail dealers and dock operators to certain essential classes of consumers. For the first time since the close of the supervisory strike in the autumn, SFAW again stressed the importance of the utmost conservation of existing stocks.

The strike in the bituminous coal mines began on April 1, after negotiations had failed since March 12 to result in an agreement between operators and workers. With the exception of a 2 weeks' truce during May, the strike continued until June 3, after the Government had taken over the mines, and had established a new Coal Mines Administration. Formal possession of the mines was taken on May 21.

Preceding the strike, production during March was estimated at 56,800,000 tons, the largest output for a calendar month since March 1927. Stocks in consumers' hands on April 1 were estimated at 58,700,000 tons, the largest since December 1, 1944, but these were unevenly distributed. By June 1, although production in May amounted to 20,420,000 tons, stocks had dwindled to about 31,642,000 tons—much lower than at any time during the war. This draw-down in stockpiles of about 44 percent as a result of the strike, put the Nation's reconversion from a war to peace economy in a precarious position.

While the SFAW was continued beyond its intended liquidation date, principally to be available if a strike occurred, with the continuance of the strike it began to appear that a serious coal stortage would face the Nation in the winter of 1946–47, and the need for further control by the Solid Fuels Administration was stressed by large and important elements interested in the production, distribution and use of coal. Later, under strong urging by the industry itself, it was decided to prolong the life of the agency. While a number of the staff and personnel had resigned to return to the industry or to accept other employment, and while a number of the field offices had been closed, the remaining staff immediately set about the task of distributing the available coal.

The loss of potential production of about 81,500,000 tons of coal during the long strike was nearly six times greater than the strike loss in the preceding autumn, and nearly three times greater than all losses in the preceding year—losses which at that time seemed ominous enough. On May 1, the Progressive Mine Workers of America, located for the most part in Illinois, went out on strike, and early in June there followed a brief strike in the Pennsylvania anthracite mines. SFAW followed its former policy of freezing one full day's production at the Progressive Mine Workers' mines, to be held on mine track for emergency distribution. Confiscation of any coal subject to distribution by SFAW on the part of railroads or other consumers was prohibited.

On May 7 further restrictions of distribution by retail dealers and dock operators were issued, limiting deliveries to certain essential classes of consumers, including public utilities, hospitals, other important industrial users, bunker fuel for vessels, and domestic consumers having less than five days' supply. Powers of SFAW area dstribution managers were extended to expedite action at points in the field. The Interstate Commerce Commission issued a service order, later extended, deferring demurrage charges for coa held on mine track by SFAW.

Effect of Strike on Utilities and Industry

When the strike began on April 1, about 200 utilities, including electri power companies, had between 20 and 30 days' supply of coal on hand another 200 had from 10 to 20 days' supply, and 100 had 10 days' supply or less. From the last week of April on, many utilities filed urgent requests with SFAW for coal. On April 30 the Administrator requested companies producing manufactured gas immediately to make use of substitute fuels in order to keep in operation.

Unbilled coal frozen on mine track and at weigh scales on the eve of the strike totaled about 1,650,000 tons. During April 713,300 tons of this were distributed by SFAW. When the truce started, only about 650,000 tons remained.

The frozen supply was so limited that none of it could be released to general industries. Some of these had very low stocks owing to their limited storage space, and they had been relying on day-to-day deliveries. Many industrial consumers not in the preference group had to retard or even suspend operations. A number of steel plants, paper mills, and other important industries closed down. During April the over-all consumption of soft coal dropped 25 percent. After mining was resumed it required several weeks for these plants to return to normal operation. At the request of SFAW, some consumers with substantial stockpiles shared with others in the community who were in less fortunate position.

In the course of the strike, the Office of Defense Transportation ordered the railroads to curtail passenger service by 25 percent, and an embargo was placed on nonessential freight. A survey on April 29 of 64 principal railroads consuming bituminous coal showed that their stocks had been cut in half since April 1. When the truce began, embargoes were lifted.

Many cities prepared to order brownouts or dimouts, and some went into effect shortly before the truce. Probably Chicago felt the greatest need for conservation of limited supplies. New York, Detroit, Philadelphia, Newark and many smaller cities also ordered brownouts. The truce made these of short duration, however, but even during the two weeks' truce, production did not return to normal.

On May 31 an interim "notice of direction" was issued, setting up three preference groups for shipments of bituminous coal from mines resuming operation, as follows: (1) Public utilities, railroads, hospitals, food processing plants, dairies, commercial bakeries, refrigeration plants, and laundries; (2) other industries, and (3) domestic consumers with less than ten days' supply, later increased for those having storage facilities. Strenuous efforts were made to move coal to the Great Lakes area, the navigation season having been greatly shortened by the strike.

At the close of the fiscal year, the interim notice of direction was replaced y the issuance of a new regulation covering the distribution of bituminous oal, and designed to increase its movement to the Lakes. It was applicable nly to coal produced east of the Mississippi River. After Great Lakes ommitments, a second preference was given to retail dealers. A third reference, to industries, prohibited unnecessary stockpiling until the close f navigation on the Lakes.

Coal for Liberated Nations

Shortly after the defeat of Germany appeals for American coal came from the liberated nations of Europe. Mining had been seriously disrupted by the war on the European continent. Manpower was short and food was scarce for those available for work. Transportation in the liberated countries was in chaotic condition, canals upon which coal was carried in peacetime were impassable, and railroads and rolling stock were in disrepair. Investigation disclosed that the greatest possible quantities of coal from the United States would have to be shipped to Europe in order to aid public utilities and essential industries, and prevent extreme hardship for the peoples.

In May 1945, the then Deputy Solid Fuels Administrator, Charles J. Potter, met the British coal representative, Lord Hyndley, and others, and they investigated the situation in Europe. The report of the Potter-Hyndley Mission, as it was termed, confirmed the alarming condition of the liberated nations and their immediate need for coal. The Secretary of the Interior decided in July to go ahead with an export program which specified that 6,000,000 gross tons of coal would be shipped between August 1 and January 1, if possible. SFAW exercised careful control over coal made available for export.

When a program to operate under the Procurement Division of the United States Treasury had been set up to undertake this task, the representatives of nine European governments sent to the United State Government, on August 11, a formal expression of gratitude. The rapid increase of strip mining in this country during the war provided a surplus of low-grade coals, usable but not in demand by American buyers, which with some run-of-mine sizes and some anthracite fines could be shipped to Europe without causing undue hardship in this country. A small quantity of special-purpose coals for gas plants was permitted to be shipped.

For the most part coal for export was purchased through agents of the United States Treasury and paid for by the recipients. A relatively minor tonnage was shipped on lend lease accounts until the discontinuance of that program. Quotas for particular nations were established by the Combined Coal Committee with the advice of the European Coal Organization. SFAW issued directions for producers to supply sufficient tonnages to meet the quotas. Neutral nations were required to shop in the open market. In spite of the foreman's strike in October, the difficulty of obtaining crews fo ships, tugboat strikes and other transportation difficulties, the export o approximately 8,000,000 gross tons of coal was accomplished by mid-February. The level of shipments reached more than 2,000,000 gross tons b March and except for the interruption of the strike have since continued SFAW not only aided the Treasury Department in finding coal for export but effected an orderly loading of vessels to prevent unnecessary use o railroad cars and congestion at the ports.

Keeping Track of the Coal

Under an arrangement with the Bureau of Mines, that agency processed all statistical data obtained pursuant to SFAW orders. Mine running-time records were compiled daily by SFAW, enabling the agency to keep account of strike and other losses in production. Current records were provided on production, distribution, consumption and stocks. Current records on costs and prices collected and maintained by the Office of Price Administration were coordinated with other statistical material for use in advising on price matters. Estimates were made on probable production and requirements to indicate the future demand-supply situations.

Compliance Problems Few

Considering the enormous tonnage of coal produced during the war, and the great number of suppliers involved—producers, wholesalers and retail dealers—compliance with SFAW regulations, orders and directives was splendidly carried out by the industry. One reason for this was the fact that SFAW consulted with the industry in preparing the regulations and kept in close relationship with it at all times.

Compliance officers in the field made periodic checks of coal suppliers, and investigated all rumors of violation. Minor violations were disposed of in the field. All cases of serious violation were referred to the Washington office for review.

During the 1945–46 fuel year, about 550 warning letters were issued, more than half of them in the spring of 1945. In most cases a warning was sufficient, many violations resulting from the fact that the recipient did not fully understand the regulations or know that he was violating them. A total of 61 prohibition notices was issued during the year, and only seven suspension orders. The prohibition notices were lifted when compliance was assured, and the suspension orders were revoked when general controls were removed.

Two cases of continued violation came before a court in Brooklyn, N. Y. The defendants were found guilty and penalized. They pleaded that the regulations were unconstitutional, but the court upheld the constitutionality of the Solid Fuels Administration's regulations.

Prospects for the 1946–47 Winter

With production losses in the spring greater than any caused by strikes during the war, with shipments to the Great Lakes lagging in early June some 9,000,000 tons behind schedule, and with a heavy European demand for export coal, the best production anticipated for the remainder of the fuel year will be barely sufficient to meet requirements, without any provision for stockpiling. It is anticipated that some coal can be shipped all-rail to the Great Lakes area, but sufficient railroad cars will not be available for long hauls of heavy tonnages. Moreover, not all of the Lake buyers have facilities to take their coal by rail. The prospect for domestic consumers is that they will not be able to obtain their normal annual supply in the better types of domestic coal and coke, but will have to supplement their supplies with some of the lower grades. Higher grades of southern Appalachian bituminous coals will continue in short supply for many months to come. Rebuilding the stockpiles of the Nation to prewar strength will be a very slow process.

Oil and Gas Division

RALPH K. DAVIES, *Acting Director*

Genesis and Purpose of New Division

THE need for coordinating in peace time the many interests of the Federal Government in petroleum, petroleum products and associated hydrocarbons, for providing a focal point of leadership and information for the numerous agencies of the Government dealing with petroleum, and for unifying the Federal policy with respect to the functions and activities related to petroleum carried on by the various Departments and agencies was recognized by the President when he ordered (Executive Order 9718) the termination of the Petroleum Administration for War, which had been the central agency in oil matters during the war. In a letter of May 3, 1946, the President requested the Secretary of Interior "to undertake the initiative in obtaining coordination and unification of Federal policy and administration with respect to the functions and activities relating to petroleum carried on by the various Departments and agencies." He stated the policy that "where practical and appropriate, governmental activities relating to petroleum should be centralized," and he directed that from time to time the Secretary of Interior submit to him "for consideration proposals looking to the accomplishment of this objective."

"Impressed with the great contribution of Government industry cooperation to the success of the war petroleum program" as exemplified by the procedures of the Petroleum Administration for War, and recognizing "the values" in the continuation of "such close and harmonious relations," he suggested the establishment of an industry organization to consult and advise with the Secretary of Interior.

Pursuant to the instructions of the President, the Secretary of Interior, by Order No. 2193 of May 6, 1946, established the Oil and Gas Division which, with a view to the conservation of the oil and gas resources of the Nation and the achievement of petroleum security, is directed to:

1. Assist the Secretary of the execution of the President's instructions to:

(*a*) Coordinate and unify policy and administration in respect to the functions and activities relative to oil and gas carried on by the several Departments and agencies of the Federal Government; (*b*) serve as the channel of communications between the Federal Government and the petroleum industry; (*c*) serve as liaison agency of the Federal Government in its relations with the appropriate state oil and gas bodies; and (*d*) review technological developments in the field of petroleum and synthetic hydrocarbon fuels and coordinate Federal policy with respect thereto.

2. Obtain and analyze information as to oil and gas matters in which the Federal Government has a proper interest and, in this connection, serve as the central Federal clearing house for statistics, technical data, and other information relating to oil and gas.

3. Keep the Secretary informed with respect to the adequacy and availability of supplies of petroleum and its products to meet the current and future needs of the Nation, and with respect to significant developments in the petroleum field, and make recommendations with respect thereto.

4. Develop proposals looking to the centralization of Federal functions and activities relating to oil and gas in keeping with the President's letter.

5. Coordinate all oil and gas policies and activities in the Department of the Interior.

Pursuant to the Executive order of May 3, 1946, terminating the Petroleum Administration for War, the personnel, records, property and funds of the Administration were transferred to the Oil and Gas Division which proceeded to wind up and liquidate the affairs of the Administration.

Upon the issuance of an Executive order amending Executive Order No. 7756, dated December 1, 1937, and the regulations and amendments approved October 27, 1942, for the administration and enforcement of the act of February 22, 1935, as amended, to designate the Oil and Gas Division in lieu of the Petroleum Conservation Division, the Oil and Gas Division assumed all the authority and duties of the Petroleum Conservation Division and the funds, personnel, equipment and records of the Petroleum Conservation Division were transferred to it and the Petroleum Conservation Division ceased to exist.

By Executive Order No. 9732, June 3, 1946, the administration of the act of February 22, 1935 (49 Stat. 30), as amended, the so-called "Connally Hot-Oil Act," was transferred to the Oil and Gas Division. The record of the Petroleum Conservation Division and the Federal Petroleum Board, the administrative agencies of the act (49 Stat. 30) for the fiscal year ending June 30, 1946, are reported later in this section.

Immediately upon the issuance of order creating the Oil and Gas Division a skeleton organization was worked out and a request for funds was made to the Bureau of the Budget and the Congress. Simultaneously progress was made in carrying out the direction of the President to create an industry advisory group. In consultation with the former Deputy Petroleum Administrator for War, the Secretary of Interior issued invitations to 85 oil and gas men to membership on the National Petroleum Council which on June 21 held its first and organizing meeting.

Petroleum Conservation Division and Federal Petroleum Board

The Petroleum Conservation Division created by Executive Order 7756, December 1, 1937, was by Executive Order 9732, June 3, 1946, transferred to the Oil and Gas Division. This division during the war was concerned primarily with the administration of the Connally Act as most of its other functions were carried on by the PAW. With the rapid liquidation of PAW functions late in 1945, the Petroleum Conservation Division increased its personnel and again turned to the problems of cooperation with oil and gas producing states in the prevention of waste and keeping informed as to the movement in interstate commerce of petroleum and its products with respect to parity between supply and consumptive demand.

The Federal Petroleum Board established under Secretary's Order No. 1753–A, dated October 27, 1942, is the successor agency of Federal Tender Board No. 1, which was established in 1935. The Board with headquarters at Kilgore, Tex., and suboffices at Houston, Corpus Christi, and Midland, Tex., and Lafayette, La., enforces regulations under the Connally Act in which process it directs an examining force which make physical inspection of production, transportation and processing of petroleum; and investigates and reports on violation of the Connally Act within areas in which there are State laws and regulations concerned with petroleum production.

From within an area which includes 106 counties in Texas, two in New Mexico, and the State of Louisiana, the Board receives reports from more than 1,600 sources. Report requirements on the operation of fields with low well potentials are suspended by the Board when they serve no useful purpose. Elimination of these stripper fields, the Board area from which reports are received includes as of June 1, 1946, 517 oil fields; 55,896 wells; 74 refineries; and 128 gasoline plants. As of June 1, 1946, 436 transporters were reporting to the Board. The reported daily production averages 2,078,514 barrels of oil, which figure includes raw condensate from wells and 132,237 barrels of casinghead gasoline and other liquefied gas from gasoline plants. This production, excluding products from gasoline plants, is about 77½ percent of the total production for Texas, New Mexico, and Louisiana and about 33½ percent of the entire national output. The refineries in the Board area handle 4,104,023 Mcf. of gas daily, most of which comes from oil wells or from condensate wells. Fields reporting oil production to the Board represent about 38½ percent of all fields in Texas, Louisiana, and New Mexico.

During the fiscal year the requirement that production reports be submitted to the Board was suspended in 134 fields and lease-operating detail on Transporter's Reports was suspended in 575 fields. New development made it necessary to reinstate the requirement for production reports in 21 fields and 86 newly discovered fields began submitting reports.

Violations of the Connally Act

As of July 1, 1945, there were nine Connally Act cases which had bee referred to the Attorney General, pending action by the Department Justice, and one civil action which was subsequently concluded favorabl to the Board by the Supreme Court of the United States in that writ o certiorari was denied the petitioners. Of these nine cases, six were concluded successfully through prosecution—assessment by the court of fine aggregating $42,000 and in one instance a suspended jail sentence. On case was continued into the succeeding 1946 term for final disposition, on case was pending trial, and one case remained on the docket of the Unite States Court at New Orleans awaiting apprehension of the indicted. Th above-described proceeding involved 1 corporate and 21 individual defendants. During the fiscal year, 37 major criminal investigations, resulting from numerous special and routine investigations, were initiated to establish violations of the act. Of these major investigations, 26 were discontinued where sufficiency of evidence as to positive violations failed in development. Two completed cases were pending prosecutive action in the Department of Justice at the end of the period, one was under review by the Office of the Solicitor, one was under review by the Director. Seven investigations were in progress at the close of the period. Three of these were sufficiently developed to justify the assignment of case file numbers.

Office of Land Utilization

LEE MUCK, *Assistant to the Secretary*

THE Office of Land Utilization was established in 1940 in theOffice of the Secretary as the coordinating agency for the land and water conservation and development programs of the Department of the Interior.

Webster defines coordination as "* * * combination in suitable relation or so as to give harmonious results; functioning of parts in cooperation and normal sequence * * *." A mechanical device cannot operate unless its parts are coordinated; and organism or organization can operate under such conditions only at reduced efficiency. Coordination in a Government department is a function of the executive of that department, but experience has demonstrated that the "span of control" of one person is so limited that in a large organization a staff, such as the Office of Land Utilization, is necessary for this purpose.[1]

Coordination of the land programs of the Department of the Interior involves chiefly the integration of investigations, reports, and plans with respect to timing, coverage, and standards; correlation of general management policies to guard against inconsistencies and to establish uniformity or harmony; prevention of duplication in investigations or operations; and resolution of conflicts between Bureaus and Offices of the Department or between the Department and other land management agencies, concerning areal jurisdiction or management or rights to the use and development of land or water resources.

The principles governing the activities of the Office of Land Utilization have been stated and restated in previous annual reports. Briefly, the Office has proceeded on the theory that the application of the fundamental principles of coordination and cooperation can be effected without overlapping or duplication and without interfering with the administrative authorities of the bureaus operating in the various functional fields. It has earnestly sought to promote unification of action directed toward a common goal through cooperative efforts, dissemination of information, and rendering of efficient advisory service.

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[1] See White, Leonard D., Introduction to the Study of Public Administration, The Macmillan Co., 1939, pp. 45–47.

Coordination of the land conservation and development programs and policies of the Department in the Office of Land Utilization is a continuing process. It is not achieved overnight through abstract consideration of these programs and policies; it is evolved gradually through day-to-day review of those routine actions of the bureaus which are submitted to the Office; through consideration of appeals to the Department from decisions of these Bureaus; through control of the allocation among the Bureaus of conservation funds appropriated on a Department-wide basis and of the accounting for expenditures of these funds; and through performance of numerous special "trouble-shooting" tasks which come before the Office involving the resolution of conflicts between agencies within the Department or between the Department and outside agencies. Constant devotion to these tasks, both routine and special, reveals the stresses and strains between various departmental programs and policies and the weaknesses in both objectives and performance. It forms the basis for a type of coordination that, although so unspectacular as frequently to go unnoticed, nevertheless is highly effective.

Accomplishments in Coordination

A brief review of the progress heretofore made in the formulation and application of a complete and coordinated program for the Department in the field of land and resource management follows. The specific accomplishments are:

1. The planning of a systematic and orderly program looking toward the conservation of the soil and water resources on all the lands under the jurisdiction of the Department.
2. The development of a more effective forest and range protection program and the coordination of forestry and range-management activities.
3. The development of more unified action in dealing with departmental problems involving the water resources of the Nation.
4. The establishment of sound land classification activities and the clarification of land policies.
5. The harmonizing and adjusting of the respective management programs and the solution of numerous day-to-day management problems.
6. The development of closer cooperation in dealing with other interests and other departments and agencies in the conservation field.

It has been clearly demonstrated that the divergent views of the several agencies which arise from different primary responsibilities can generally be brought into reconciliation. The work so far accomplished has demonstrated the need for still greater expansion of these efforts and a more intensive use of coordinating principles in providing for more systematic and effective administration.

Progress on the departmental program for securing integrated management of the lands and resources under its jurisdiction has been severely limited by wartime restrictions on nonmilitary operations. Most of the bureaus concerned have operated with reduced personnel and funds under a hold-the-line procedure pending the termination of the war. This situation has not been conducive to progress. It has, however, served to accent the need for close cooperation that will be of material aid in effecting greater progress in the future.

There follows a detailed description of the accomplishments in the respective fields in which the Office of Land Utilization has been the coordinating agency:

Soil and Moisture Conservation

Soil and water are the Nation's most important resources. Food from American soil was an important factor in winning the war and is now playing a spectacular role in preventing starvation of millions of people in war-ridden countries. It may well be one of the most important elements in the foundation of world peace.

Soil and moisture conservation is concerned with the loss of soil and water and with the deterioration of the soil for productive use. The Department of Agriculture estimates that the annual cost to the United States as a result of uncontrolled erosion and water run-off is more than $3,800,000,000. During the past 5 years the soils of this Nation have been forced to yield more than in any previous period of equal length. They have been taxed to the limit, and the need for their rehabilitation should be readily apparent.

The total land area of the United States, according to the 1940 Census, is 1,905,000,000 acres. Preliminary estimates by the Department of Agriculture show that 1,821,000,000 acres need examination and some treatment to attain the best use of land and to maintain the soil, and that 300,000,000 acres are in critical condition from erosion.

The erosion problem on Department of the Interior lands is more serious, if anything, than the general erosion problem of the country. The 282,000,000 acres under the jurisdiction of the Department for the most part constitute the undisposed remnant of a once vast public domain of almost a billion and a half acres. For many years this part of the Federal estate had little or no management or protection. More than 20 percent of the area is in critical condition, and almost half of it needs treatment to restore it to maximum sustained productivity.

In accordance with the President's Fourth Reorganization Plan of 1940, the Department of the Interior is responsible for carrying on a soil and moisture program on the lands under its jurisdiction. During the past 5 years, 4 of which were war years in which operations were carried on under a reduced budget, the accomplishments have been limited but definite in scope.

The erosion problem on all the lands under the jurisdiction of the Department has been segregated and it has been determined with reasonable accuracy that 60,000,000 acres are in a stage of critical erosion; 73,000,000 acres are moderately to severely eroded; and 149,000,000 acres show signs of slight to moderate erosion. Of the 60,000,000 acres in critical condition, erosion has ruined 14,000,000 acres for production; 21,000,000 acres are submarginal; and 25,000,000 are marginal.

Plans have been made and project operations initiated looking to the control of erosion forces on the 60,000,000 acres of severely to critically eroded land, and progressive conservation treatments have been initiated on approximately 11,000,000 acres of these lands.

An increasing awareness has been developed among land administrators of the dangers from erosion, with a resulting improvement in land and resource management practices on Department lands. Likewise, a constantly increasing amount of cooperation has been secured from users of the land and from other agencies operating in the soil conservation field.

Plans have been outlined for a more widespread and effective attack on soil erosion in anticipation that the necessary funds will be made available to the Department on a basis proportional to the funds now provided for private lands.

The Soil Conservation Program of the Department of the Interior is an important segment of the soil conservation program of the Nation. In general, departmental lands are more seriously depleted than lands in private ownership for the restoration of which vast sums are provided by Congress. For the current fiscal year of 1947 Federal funds are available for Interior lands at the rate of fifty-six hundredths of a cent per acre in contrast with approximately 22 cents per acre, or about 40 times as much, for private land. Unless funds are made available to the Department of the Interior for the performance of needed soil and moisture conservation work on a basis comparable with the funds provided for intermingled private lands, the gains made on these private lands will be largely dissipated.

The application of curative practices to lands abused for 50 years or more is a progressive, time-consuming action in which the assistance of nature is required. The variableness of climate and of growing seasons for vegetation and many other factors must be considered and planned for.

The revegetation of depleted lands, particularly those areas on the watersheds above some of the larger reclamation projects, is the most important part of the soil and moisture conservation program of the Department of the Interior. It is a difficult problem at best since, in addition to the normal difficulties involved in revegetation of any land, there is the problem of distance from sources of labor and supplies for use at the right time of the year to perform revegetation work.

There are many areas where the amount and quality of vegetation have been greatly impaired and in some instances actual destruction has occurred, so that the surface of the ground is bare. As a general rule, these areas are of considerable extent and of rough topography in addition to being comparatively inaccessible. Furthermore, revegetation to be successful at all must be done during the brief periods when moisture conditions are most favorable. This combination of conditions definitely precludes the use of conventional farm machinery.

Much has been learned regarding the possibilities of revegetation on a small scale and under closely controlled operations. No final answer has been devised for revegetation on the broad scale necessary on the vast areas of public lands. However, a demonstration project is being conducted in speeding up range reseeding through the use of an airplane. The demonstration involves sowing certain suitable species of grass seed on a number of areas totalling 50,000 acres on Indian reservation lands in the State of Arizona. While sufficient time has not elapsed for fully determining the efficiency and value of this method, the present indications are very encouraging.

During the 5-year period heretofore mentioned, it has been possible to perfect and put into action nearly 5,000 farm conservation plans on Indian lands, which represent the primary operations on cultivable lands. On range and other lands the work performed has consisted of the construction of large numbers of small reservoirs and stock-watering places, the building of a large mileage of control fences to protect areas that have been reseeded or which are overgrazed and need to be rehabilitated, the construction of many thousands of small check and gully control dams, the successful revetment of eroding stream channels, and numerous minor but necessary companion operations.

During the fiscal year 1946, because of financial and other limitations, only about 1,200,000 acres of land were thus progressively treated. The progress made in 1946, if used as a measure in planning the correction of the adverse conditions on 60,000,000 acres of severely to critically eroded land, is not encouraging. Fifty years will be required to do a job that should be done in 10 years or less if the lands in question are to be saved for the future use of the Nation. Meanwhile, another 73,000,000 acres are deteriorating too rapidly. Every year more land enters into the critical erosion class.

Forest Management

The program of the Office of Land Utilization in the field of forest management has been directed toward adequate protection from loss by fire, insects, or diseases for all the vegetative resources on lands administered by the Department; consummation of cooperative sustained-yield agreements with owners of forest properties adjacent to or intermingled with Department of the Interior lands; and adequate technical management of forests on unreserved and unappropriated public domain lands in the continental United States and Alaska. The accomplishment of these objectives will aid greatly in placing forest management on lands under the jurisdiction of the Department on a basis of sound business practice, with due regard for technical forestry principles.

Forest protection.—When the departmental war emergency appropriation "Fire protection of forests, forest industries, and strategic facilities (national defense)" was discontinued, the Congress, at the request of the Office of Land Utilization, increased the respective Bureau appropriations, in lieu of the funds formerly provided in the emergency appropriation, in amounts sufficient to provide more nearly for adequate fire control on the forest, brush, and grass lands under their jurisdictions. Appropriations for fire control now stand at their highest level in the Department's history. While, largely because of the rising costs of labor and equipment, these funds are not yet sufficient to provide adequate protection against fire, the several agencies concerned are much better prepared than ever before to cope with the fire problem. The fire control record of the Department during the war period, in the face of shortages of all kinds, is concrete evidence of progress in this direction. From the calendar year 1942 through the calendar year 1945 the number of fires was reduced from 3,316 to 2,435 and the Federal area burned from 1,879,613 to 844,583 acres.

At the suggestion of the Office of Land Utilization, arrangements were made between the General Land Office (now the Bureau of Land Management) and the Forest Service of the Department of Agriculture, and later approved by the Congress, whereby the General Land Office would reassume on July 1, 1945, its responsibility for the protection from fire of the forests lying on the unreserved and unappropriated public domain in the continental United States outside of the grazing districts. Since 1938, funds for fighting forest fires on these lands had been appropriated by the Congress to the Forest Service. Pursuant to the authority carried in the Interior Department Appropriation Act, 1946, the General Land Office consummated contracts with the States of California, Montana, Minnesota, Oregon, Arkansas, Washington, and Idaho, and with the Forest Service, which provided collectively for the protection of 3,981,208 acres of public domain at a cost of $190,395.06 during the fiscal year 1946.

The Office of Land Utilization, as liaison office for the Department with the Bureau of Entomology and Plant Quarantine in the Department of Agriculture, continued its coordination of the white pine blister rust control program. This tree-disease problem involves the suppression of the disease-spreading alternate host plants (currants and gooseberries, commonly called Ribes) on white pine producing areas in the United States. These lands consist of approximately 28,000,000 acres, of which 715,397 acres are Interior Department lands under the jurisdiction of the National Park Service, the Office of Indian Affairs, and the Bureau of Land Management. Although the control program during the war period was largely one of holding the disease in check, considerable progress was also made towards completing the initial suppression work and required rework that would place the program on a maintenance basis. On December 31, 1945, a total of 381,784 acres had been worked over once and a total of 201,302 acres were considered to be on a maintenance basis requiring a field investigation only every 4 or 5 years. Plans were complete at the end of the year to conclude the program for initial eradication of the Ribes within 5 years, beginning with the fiscal year 1947.

Cooperative sustained-yield agreements.—A major advancement in the sustained-yield management of the approximately 2,500,000 acres of the Oregon and California revested grant lands was the declaration on November 28, 1945, by the Secretary that their annual timber-producing capacity is 606,664,000 feet, board measure. This declaration, which was authorized by the act of August 28, 1937 (50 Stat. 874), and was supported by exhaustive field examinations, increased the potential production annually of the O. and C. lands by 106,664,000 feet. The announcement was followed by the first formal hearing on a proposed cooperative sustained-yield master unit (the Siuslaw master unit) which was held on December 3, 1945. It was open to all interested persons, including Federal, State, and local officials, and representatives of dependent industries, local residents, and labor. The recommendations received at this hearing are now undergoing the essential review prior to the formal establishment of the unit. The future program provides for similar hearings on the other 11 master units and the some 107 sustained-yield management units to be organized within the 12 master units.

Management plans.—Plans for the orderly utilization of the timber from the public domain, both in the interior of Alaska and in the continental United States, under technical forestry principles and good business methods, were advanced in a major way by the organization of a forestry division within the General Land Office on March 19, 1946. This division is now responsible for the establishment of effective procedures for the management of the forests on the public domain. At the same time the Alaskan Fire Control Service, which now includes timber sale activities on the public lands in Alaska as well as fire control under its direct supervision, was made responsible to the Forestry Division. For the first time since February 1, 1905, the way is now clear for a start to be made toward providing intensive management for the forests on the unreserved and unappropriated public domain in the continental United States and Alaska.

Timber sales.—The end of the war did not lessen the demand for timber products and there has been no decrease in the timber sale operations conducted on the lands under the jurisdiction of the Department. The heavy demand for lumber for postwar construction gives promise of continuing for some time to come. During the year the timber sale operations on Department lands constituted a business amounting to more than $3,621,000 in value. The total amount of timber cut during the year was slightly under 1,000,000,000 feet.

Water Resources Committee

The general objective sought by the Water Resources Committee is to insure the coordination of the water-development programs within the Department, in order that full recognition may be given to the over-all benefits to the Nation.

The staff work of the Committee, established by Departmental Order dated May 2, 1944, was conducted by the chairman and the executive officer. Twelve formal meetings were held, and in addition the executive officer represented the Committee at 12 meetings of the Federal Inter-Agency River Basin Committee, 9 meetings of the subcommittee on hydrologic data, and numerous other committee meetings having to do with intra- and inter-agency coordination and cooperation.

The interests of the various agencies of the Department with respect to numerous water-project and basin-wide reports were coordinated, and assistance was rendered in the preparation of these reports, which included project reports on Mountain Home and Lewiston Orchards, Idaho; Paonia, Colo.; and Santa Barbara County, Calif.; and departmental basin reports covering the Central Valley of California and the Colorado and Columbia Rivers.

Thirty flood control and river and harbor reports of the Corps of Engineers, War Department, covering areas lying west of the Ninety-seventh Meridian were reviewed by the Committee in accordance with the Flood Control Act of 1944 and the Rivers and Harbors Act of 1945, and reports on these documents were made by the Secretary to the Chief of Engineers.

A meeting of the Committee and of representatives of interested agencies was held at Omaha, Nebr., on March 27, 28, and 29, 1946, at which recommendations and procedures were adopted leading to the establishment of the Departmental Missouri Basin Field Committee for the purpose of expediting and coordinating the Department's program in the Missouri River Basin. This Committee was established by Departmental Order dated May 31, 1946.

The executive officer acted as liaison with the Missouri Basin Inter-Agency Committee and with the Columbia Basin Inter-Agency Committee. Detailed information concerning water projects, laws, policies, and related features were assembled and made available to interested agencies of the Department.

The progress made in the coordination of the water development programs of the Department of the Interior has been encouraging; and procedures laid down by the Congress in the Flood Control Act of 1944 and the Rivers and Harbors Act of 1945, and carried forward in current omnibus bills, have greatly strengthened the cooperation between Federal agencies and between Federal agencies and the States. Much remains to be accomplished, however, before the degree of cooperation essential to sound management in this complicated field can be completely obtained.

Land Classification

The Office of Land Utilization continued its review of public land cases which required approval by the Secretary. Approximately 1,300 cases were examined in connection with requests for State exchanges, indemnity selections, rights-of-way, withdrawals, and reservations. In addition, upward of 200 applications for homesteads, public sales, exchanges, grazing leases or permits, or other disposal or use of the public lands, on appeal to the Secretary from adverse decisions of the General Land Office, were examined, and recommendations submitted as to the decisions that should be made. Most of these cases involved highly controversial issues concerning the suitability of the lands for particular uses or their value to particular persons.

A survey of land areas used for military purposes during the war, which might be suitable for administration by the Department if and when declared surplus by the War and Navy Departments, was made during the year in response to a request by the Bureau of the Budget. A list of 69 such areas was submitted to the Bureau of the Budget as a basis for proposed legislation authorizing the transfer of the areas to the Department of the Interior upon their being declared surplus.

Under instructions from the Secretary of the Interior, the Department has begun the compilation of a preliminary inventory of the natural resources of the United States, including the farm lands, the range lands, the forests, the minerals, the wildlife, the fisheries, the water resources, and the recreational resources. Direction of the inventory has been assigned to the Office of Land Utilization.

Civilian Public Service Camps

The Office of Land Utilization continued to represent the Department and the bureaus concerned in all matters relating to the operation of civilian public service camps on Department of the Interior lands requested by the Selective Service System.

These camps are manned by men subject to combatant training and service in the land and naval forces of the United States who by reason of religious training or belief are found to be conscientiously opposed to participation in war. By agreement between the Department and the Selective Service System, the program of work on Interior lands is confined to the protection and conservation of natural resources, including fire, insect, and disease control, and water conservation projects.

By reason of the end of the war the number of civilian public service camps operating on Department of the Interior lands was gradually reduced from 10 active camps at the beginning of the year to 3 at the close of the year—2 on national parks and 1 on a national wildlife refuge.

General Land Office

FRED W. JOHNSON, *Commissioner*[1]

RECONVERSION of its World War operations to meet national demands for maximum peacetime use of the public lands and their natural resources, was the major undertaking of the General Land Office during the 1946 fiscal year. The transition from providing millions of acres of land for troop training, bombing range, tank maneuvering and other military uses to a program affording postwar opportunities for settlement on public domain areas, particularly in Alaska, was well under way at the close of the fiscal period.

Rapid progress also had been made in a similar rechanneling of the millions of tons of minerals, millions of gallons of petroleum products, and millions of board feet of timber and other forest products from military purposes to meet the requirements of a stabilized postwar industrial economy. At the same time satisfactory progress was made in formulating plans to clear away the accumulation of land administration problems which for the past 5 years have been dammed up behind exigencies of the military program. More than 100,000 cases involving land administration problems of essential, though not of such urgent importance as to demand immediate attention in the midst of the military program, were conservatively estimated to form part of the year's work, while a backlog of responsibility involving the survey or resurvey of more than 100,000,000 acres of public land—projects already authorized but laid aside for immediate war-connected survey tasks—remained on the General Land Office books.

Reorganization

Definite steps toward streamlining the work of the General Land Office to meet the new and increasing responsibilities of the post-war era were taken near the close of the fiscal year. In May 1946, President Truman submitted to Congress Reorganization Plan No. 3, which provided for a consolidation of the General Land Office and the Grazing Service in the Department of the Interior into a new Bureau of Land Management.

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[1] On July 16, 1946, the General Land Office was consolidated with the Grazing Service to become the Bureau of Land Management in the Department of the Interior. Mr. Johnson was named Acting Director of the new Bureau.

Details of the rearrangement of the General Land Office structure and procedures were brought close to completion by the end of the fiscal year, thus paving the way for early effectiveness of the President's program to remove unnecessary duplication in land administration activities and insure maximum efficiency in transaction of the Government's business in the public interest.

Meantime, the establishment of the Bureau of Land Management marked the termination as a separate identity of one of the oldest agencies in the Federal Government. It also opened a new chapter in the history of public land administration in the United States which had its inception with the beginning of the Republic itself and in all of which, with the exception of its earliest beginning, the General Land Office, first established as a Bureau in the Treasury Department in 1812, had played a direct part.

Chronologically, Federal land administration began with the Ordinance of 1785, largely sponsored by George Washington and Thomas Jefferson, under which the Continental Congress directed that identification of land in the new Republic should be undertaken on the standardized pattern of townships 6 miles square. Thereafter disposal of the public lands in accordance with the survey system was carried out by the Treasury.

In 1812 the General Land Office was set up as a Bureau in the Treasury Department for the handling of administrative matters involving the public domain, and when the Interior Department was established in 1849, the General Land Office was transferred to that Department. Throughout the 97 years which followed, the Office, serving in its capacity as official real estate agent of the Government, played a striking role in the advancement of American civilization westward to the Pacific. Making Government land available for settlers, for the construction of transcontinental railroads, mineral development, and other activities, the volume and rapidity of Office operations at one time led to the coining of the popular phase, "doing a land office business."

Meantime, the Congress carried forward a systematic enactment of new laws affecting the administration of the Federal public domain until today the body of public land law is made up of more than 5,000 statutes which serve as the basis for adjudicative and administrative procedures.

The wide scope of problems and responsibilities confronting the General Land Office in its administration of the Federal public lands is shown by excerpts from the first and the last annual reports made by the Commissioner of the General Land Office to the Secretary of the Interior. For example, J. Butterworth, Commissioner, in the first annual report to Secretary of the Interior Thomas Ewing, pointed out that: "The successful application of steam to the purposes of navigation, the result of American genius, has produced a new era in the world. It required only proper encouragement to develop the boundless resources of our country in mind and matter and to lead to results equally important in every department of science." At another point the first Commissioner refers to survey work in Wisconsin, Iowa, and some of the Northern States, and declares that "These lands are difficult of access and for the greater part of each year are shut in by impassible barriers of ice and snow." All these in sharp contrast to items in this, the ninety-seventh annual report, which call attention to the potential increased use of the public lands in connection with international air lines and the advancement of plans for the broad economic development of Alaska.

Development of Alaska

More than 90 percent of the Territory of Alaska consists of vacant public land whose disposal or the development of its natural resources under the public land laws is a direct responsibility of the General Land Office. Consequently, plans for the future maximum beneficial use of the public domain areas in Alaska formed an important part of the work program of the Office during the 1946 fiscal year.

Stimulated by a public interest in the Territory greater than ever before in recent years, demands for information concerning living conditions and opportunities in Alaska at times literally swamped the facilities of the Office directly engaged in public land administration in the Territory. Thousands of ex-service personnel and other potential travelers over the newly completed Alaska Highway, were furnished with informational material prepared by the General Land Office during the year.

At the same time, definite steps were taken to promote economic development and wider utilization of public domain areas in the Territory. Special field parties of land experts were sent to Alaska during the year to ascertain and evaluate the possibilities for increased agricultural settlement in the Territory and other measures, looking to maximum land use, were set under way.

Early in the administration of the public land in the Territory under national conservation policies, it was deemed advisable to reserve large areas of shore space from general use in order to provide access to the interior of Alaska. Having served this initial purpose, it was determined during the fiscal year that current Territorial development requirements warranted the abrogation of some of this shore space reserve; a special examination to ascertain which portions of the areas may now be made available for settlement or other use under the public land laws was begun by the General Land Office during the year.

Construction of the Alaska Highway, affording an overland route from the United States into the Territory, was an outstanding achievement in connection with the prosecution of World War II. When construction of the highway was begun, a strip of land 10 miles wide on each side of the road's proposed route was withdrawn from general public use, thus removing approximately 8,300,000 acres of public domain which otherwise would have been susceptible of utilization in the development of the mineral and other natural resources in the Territory. The withdrawals were made with the intention on the part of the Department of the Interior that the areas would be restored to general public use as soon as the need for their use under the military program has ceased. Accordingly, arrangements had been brought near completion at the end of the fiscal year for a reduction in the size of the withdrawals and the retention of merely a small right-of-way strip along the highway thus restoring large areas of the Federal domain to public use.

Similar action was taken shortly after the close of the fiscal year in connection with more than 18,600,000 acres located on the Alaska and Kenai Peninsulas originally set aside for the development of possible petroleum supplies for the armed forces in the Territory during the war.

Revenues

For many years the General Land Office has been one of the few agencies of the Federal Government whose operations have resulted in revenues in excess of the cost of administration. In the 1946 fiscal year total receipts from its activities amounted to $13,104,067, and expenditures out of appropriations of only $2,822,662. This surplus of receipts over expenditures represents a ratio of $4.64 in revenue for every $1 spent on the operation of the Office.

Review of the Year's Work

Detailed accomplishments during the 1946 fiscal year by the various elements in the General Land Office structure may be briefly outlined as follows:

The need for use of the Federal public domain as a source of materials with which to win the war, in some instances, resulted in a relaxation of conservation safeguards against a too rapid depletion of the Nation's supply of natural resources; the cessation of hostilities afforded opportunity for the restoration of these safeguards which found its reflection in the volume of work confronting the General Land Office during the year. Based on current demands for the protection of the public lands to insure their maximum beneficial use in the postwar economic period, the divisions in the Office primarily charged with the scientific solution of land administration problems were called upon to make definite contributions in research, analysis and land classification operations.

Postwar requirements for an increased supply of timber from the Federal lands was an outstanding problem which engaged the attention of the Research and Analysis Division during the fiscal period. Detailed plans were formulated for the inauguration of the sustained yield program of forest management on public lands of the United States, under which a safe balance between the volume of tree cutting and of tree growing is maintained to insure a perpetual supply of raw material.

At the same time a broad streamlining of administrative processes in Alaska which would permit a wider degree of utilization of timber products on the public lands in the Territory was begun.

One of the present handicaps to complete success in the administration of Federal real estate is the lack of a consolidated record of property owned by the Federal Government. With legislation pending in Congress for the ultimate establishment of such a central inventory, the General Land Office and its divisions were called upon during the year to conduct preliminary studies as to the best methods for putting such a system into operation. At the same time expert assistance was rendered the Territorial Government of Alaska in the preparation of plans for the recordation of real estate titles in the Territory.

Meantime, progress was made during the year in the compilation of inventories and other records to facilitate the administration of the public lands. County maps and tabulations showing the pattern and land ownership status as of 1940 of the remaining public domain lands are now available for the following States: California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming, and other records were augmented during the year as a result of the Divisions' work.

One of the major requirements in the disposal of the Federal public lands today is that the area sought must be suitable for the use to which it is intended to be put. Thus, the land must be classified before an application for its acquisition can be approved. This classification is the primary responsibility of the General Land Office involving a heavy volume of work during the fiscal year. Not only was considerable work undertaken in Alaska, where heavy demand for land settlement opportunities made necessary the delineation of areas suitable for agricultural expansion, but a comprehensive program of land classification work in the United States was carried forward during 1946. Particularly, the demand for lands under the Federal law which permits the leasing of small areas for home, cabin, camp, health, convalescent, recreational and business sites, commanded much attention from the scientific classification branches in the Office. Although California and Arizona continue to be the focal points in the demand for these sites, considerable interest was shown in areas in Nevada, New Mexico, and Florida during the year. In the aggregate, preliminary work leading to the classification of over 75,000 additional acres which might be found suitable for small tract use was accomplished during the year and the area classification work provided the basis for approximately 10,000 leases applied for by veterans and others during the year.

In addition, land classification work was started during the year in the Missouri River Basin. Under this program physical and economical data relating to the classification, development and management of public lands will lay the foundation for land development and management activities in the basin.

Protection of millions of acres of Federal public land against damage by fire was one of the new responsibilities placed upon the General Land Office during the 1946 fiscal year by direct mandate of Congress. As a consequence plans were made and negotiations set under way looking to the protection of these lands through contracts with Federal and State agencies. In the aggregate 4,000,000 acres of public land were protected through fire contracts costing approximately $198,000.

New problems of postwar land administration, the solution of knotty legal problems arising from the accumulation of war-postponed cases and the preparation of policies and regulations essential to the operation of new Federal land statutes, placed an unprecedented volume of work upon the Law Division of the General Land Office during the 1946 fiscal year. In addition to the task of reviewing more than 27,000 items of legal importance during the year, the Division was instrumental in the collection of more than $50,000 through the enforcement of laws against trespass on the public lands and other claims for amounts due the United States. Legal experts of the Division were called upon to assist in the negotiations relating to the consolidation of the General Land Office with the Grazing Service into the Bureau of Land Management of the Department of the Interior, and much legal assistance was rendered in the handling of surplus property whose disposal was undertaken by the Office as part of the Nation-wide war assets liquidation program.

Among the proposals for Federal legislation prepared in the Division during the year was a bill designed to give full effect to the proclamation by the President that all the natural resources of the subsoil and seabed of the Continental Shelf, off the shores of the United States, were the property of the Federal Government.

Rules and regulations reserving to the United States complete control and ownership in uranium, thorium and other fissionable materials essential to the development of atomic energy also were prepared by the Division during the 1946 fiscal year.

The General Land Office maintains about 4,000 tract books on which notations are made of all transactions affecting the public lands. These volumes are designed to show at all times the status of each smallest legal division of the public lands. More than 100,000 notations were made on these records during the fiscal year.

The adjudication of applications and claims for tracts of the public land of the United States is a responsibility resting upon the General Land Office which is equally as important as the necessity for adequate scientific planning and sound legal interpretation in the administration of the broad expansion of public domain in the postwar period. This highly essential, though unspectacular work, is performed by the several adjudicating divisions in the Office whose operations produce the major part of the revenue collected during the year as a result of its activities.

Outstanding among the year's work was the handling of thousands of cases involving the development of oil and gas and other mineral resources on the public lands. Shortly after the close of the fiscal year 1946, the Congress enacted amendments to the Mineral Leasing Act of 1920 providing for a reduction in the royalties to be paid the Government and other features calculated to result in increased opportunities for exploration, discovery and development of any supplies of these products for use in the postwar period.

Another division in the General Land Office handled more than 2 dozen types of land administration cases, among them being the processing of applications for homesteads on Federal reclamation projects and the final closing out of the historic railroad land grants under which in earlier periods of American history Federal land was granted for the construction of transcontinental railroads. One section of the Transportation Act of 1940 provided for the termination of this type of Federal land grant and legislation was before Congress at the end of the fiscal year to provide a policy for the administration of all the land, claims to which were relinquished by the railroads.

What to do with land purchased or otherwise acquired during the war and added to military reservations of the United States is a problem which confronted Congress and the General Land Office in the 1946 fiscal year. With the enactment of the necessary statutes much of the surplus land in present military reservations might be made available for settlement or natural resource development, and another division in the Office prepared in 1946 to give full effectiveness to any legislation which subsequently may be enacted.

The lease of public land areas for use as hangar sites and other operations incident to the maintenance of public airports is another problem confronting the General Land Office in the postwar period which awaits congressional action.

The leasing of land for the grazing of livestock on areas of the Federal public domain so small, scattered or isolated as to prevent their inclusion within an established Federal grazing district formed another one of the land administration responsibilities of the Office during the past year. Under these operations more than 11,600,000 acres of the Federal domain were made available for grazing through the issuance of approximately 10,000 leases with a total revenue return to the Federal Government of $235,534 in rental.

A broad program of range development and improvements in connection with the use of these leased areas was included in the operations of the General Land Office in 1946, made possible through the allocation under the Taylor Grazing Act of a portion of the proceeds from the lease of the public lands. A comprehensive schedule of construction work including the building of dams, reservoirs and watering places, as well as the erection of fences and corrals, was prepared for completion as rapidly as shortages in materials and labor will permit.

Surveying the Public Lands

Because no tract of land properly may be set aside for any use until its location and boundaries have been accurately determined and permanently recorded, the Government's cadastral surveys have been the basic foundation in negotiations for the disposal, exchange, withdrawal or other change in the status of the public domain areas since 1786.

Differing from the type of survey work which involves primarily the recording of geographic or historical features of the terrain, cadastral surveying consists of careful measurement of the areas of land on the ground, the recording of such measurements by the placing of monuments or other markers, and the preparation of maps scientifically compiled from notes made by trained engineers at the time of the on-the-ground measurements. First undertaken by the General Land Office when the system of public land surveys decreed by the Continental Congress was transferred to its jurisdiction in 1812, maintenance of a Cadastral Engineering Service has been a continuing responsibility of this office.

During the 1946 fiscal year cadastral activities were carried on in 22 States and the Territory of Alaska, under 62 separate groups. A total of 7,950 miles was surveyed or resurveyed, embracing 1,125,557 acres. Among the outstanding accomplishments of the year was a completion of surveys in areas in the vicinity of Twenty-nine Palms, Calif., by which land was made available for use by thousands of applicants seeking portions of the public domain under the small tract leasing act. Another unusual survey involved the determination of the geographic position of initial points of four principal meridians in the States of Alabama, Arkansas, Florida, and Louisiana. Survey work in connection with the development of the Missouri River Basin also formed an outstanding part of the year's work performed by the Cadastral Engineering Service.

Meantime, better administrative procedure was made possible during the year by a reorganization of the Service and regrouping of its district organization. Under the reorganization district No. 1, which originally included Colorado, Wyoming, South Dakota, and Nebraska, was enlarged to include the States of Montana, North Dakota, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Michigan, and Ohio. The headquarters of this district are maintained in Denver. District No. 2 was expanded to include the States of New Mexico, Arizona, southern California, Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, and Florida, with headquarters at Santa Fe. Idaho was added to Utah and Nevada to comprise district No. 3, with headquarters retained at Salt Lake City. Oregon, Washington, and northern California were regrouped into the fourth district, with headquarters at Portland, Oreg.; and district No. 5, embracing the Territory of Alaska, remained unchanged with headquarters at Juneau.

District Land Offices

A record of nearly 150 years of untinterrupted service to the public in the administration of the Federal domain was established during the 1946 fiscal year by the network of district land offices maintained under the supervision of the General Land Office. Serving as the first point of contact with the thousands of settlers, who, through past generations sought new hearths and homes on the public lands, original "over the counter" transactions in these offices, in many instances, marked the beginning of many of the land administration problems which accompanied the development of the Republic westward to the Pacific.

With the establishment of the first district land office in Ohio in 1800, these outposts of land management spread throughout the West and reached a total of 393 offices at the height of the national public land disposal program. Whenever most of the Federal domain within a land district virtually had passed from the Government into private hands, the offices were closed and the land records transferred to the State authorities.

Today there are 25 district land officees loctated in 13 Western States and the Territory of Alaska in which applications for use of the Federal land and its resources may be filed and other negotiations in connection with the public domain may be carried on in direct "over the counter" proceedings based upon more than a century of experience in these transactions. The location of the district land offices is as follows:

- Alaska:
    - Anchorage.
    - Fairbanks.
    - Nome.
- Arizona: Phoenix.
- California:
    - Los Angeles.
    - Sacramento.
- Colorado:
    - Denver.
    - Pueblo.
- Idaho:
    - Blackfoot.
    - Coeur d'Alene.
- Montana:
    - Billings.
    - Great Falls.
- Nevada: Carson City.
- New Mexico:
    - Las Cruces.
    - Santa Fe.
- North Dakota: Bismarck.
- Oregon:
    - Lakeview.
    - Roseburg.
    - The Dalles.
- South Dakota: Pierre.
- Utah: Salt Lake City.
- Washington: Spokane.
- Wyoming:
    - Buffalo.
    - Cheyenne.
    - Evanston.

Negotiations relating to public lands in States in which no district land offices are maintained are handled through the Washington headquarters.

Branch of Field Examination

Proper observance of the public land laws is an element of administration equally as important as that of land identification by the General Land Office. The enforcement of the laws and the prevention of trespass and other depredations on the public domain are the primary responsibilities o the Branch of Field Examination which, during the 1946 fiscal year, carried out investigations in 27 States and the Territory of Alaska.

Geographically grouped so as to afford speedy action upon the varie problems confronting the service, the Branch of Field Examination force include civil, mining, and metallurgical engineers, geologists, lawyers auditors, timber and range specialists, and others experienced in land law and procedure. Regional offices are located at San Francisco, Calif. Billings, Mont.; Salt Lake City, Utah; Albuquerque, N. Mex.; Anchorage Alaska, and Washington, D. C.

Under national conservation provisions of the Federal statutes publi lands today must be designated as suitable for disposition in accordanc with the particular law under which an application is filed before favorable action can be taken. The making of field investigations to determin the availability of the land and its resources formed a major factor in th work of the Branch during the year. The data gathered in these investigations furnished the basis for decisions as to allowance or rejection of th homestead, desert, private or public exchange, timber, and stone or other application. Tracts of land embraced in public sale, exchange and othe applications were appraised on the ground.

Land use studies of areas to determine whether they should be set asid for disposition or lease under the small tract law, devoted to recreationa purposes for general public use, or turned over to the other State or Federa agencies to insure better utilization, also formed part of the Branch work program in 1946.

Considerable work was performed in connection with the appraisal, sale and disposal of improvements and properties used during the war, which were later declared surplus and turned over to the General Land Office for disposition.

In Alaska, all surplus real property is disposed of by the General Land Office, and during the past year appraisals have been made at several Alaskan points, chief among which were the Chilkoot Barracks, Fort Raymond, and the Seward Harbor Defense Area. In the United States the Branch of Field Examination made appraisals of various properties declared surplus prior to their disposal, one of which was Heart Mountain Relocation Center, in Wyoming, which , incidentally, while in use, was the third largest town in the State. Other areas which were appraised preliminary to sale, are the Manzanar and the Tule Lake Relocation Centers in California, the Umatilla depot project in Oregon, the Willapa Bay Military Reservation in Washington, the Minidoka Relocation Center in Idaho and the Gila River and Colorado River Relocation Centers in Arizona.

The examination and appraisal of patented and unpatented mining claims, preliminary to clearing title to the lands within military and other projects, was carried forward in 1946, and progress was made on the elimiation of invalid claims and on the appraisal of valid claims and patented ands preliminary to their acquisition by purchase or condemnation.

The work of the year also involved investigations in connection with he use of public land areas in the development of the Missouri River Basin nd other projects under the national reclamation development program. n addition, investigation of more than 93,000 acres of land in Montana nd Wyoming, was made to determine its possibility for grazing use in areas itherto withdrawn for reclamation construction purposes.

The original field service unit of the General Land Office was organized o combat the unlawful cutting of timber on public land, and was named he "Timber Trespass" division. The investigation of trespasses is still an mportant function and is currently handled by the Branch of Field Examination. Such trespasses involve timber cutting, illegal mining of coal, removal of gravel and other resources, and illegal occupation of public lands. Complaints are investigated and the evidence collected is used as a basis for civil proceedings, where necessary, to collect damages, and in aggravated cases, results in criminal prosecution. Examiners also frequently assist the United States Attorney, at his request, in the preparation and trial of these cases.

In the past fiscal year, settlement has been made in 348 trespass cases which resulted in the recovery of a grand total of $44,081.

An important feature of the conservation of natural resources is the protection of valuable timber stands on the public domain, particularly since the demand for lumber during the war unfortunately denuded considerable land chiefly valuable for timber culture. Supervised sales of timber on public lands have not departed from recognized principles of conservation and a large number of sales of mature timber, including insect-infested and dead and down timber, have been made, following a check in the field by examiners qualified as logging engineers.

The regional office at Anchorage, Alaska, rendered its first year of service in 1946, and the results reflected numerous benefits to all concerned. The problems arising in the Territory differ only as climatic conditions and applicable laws differ. Much land is available there which can be adapted to agricultural purposes. Trade and manufacturing sites, fur farms, grazing leases, and other forms of entry afford many opportunities to the pioneering settler. Recreational advantages are of interest both to residents and those from "stateside." During 1946, the office personnel devoted much time to furnishing assistance and information to the residents, and others interested in Alaska's vast resources, and results have fully justified the establishment of a regional office there. It is anticipated that improved travel and communication facilities will result in expediting the handling of public land matters between Territorial residents and the General Land Office.

Sustained Yield Forestry

After nearly a decade of successful operation, marked advancemen toward the goal of a perpetual supply of timber and other forest produc for America's economic well-being was recorded in the Pacific Northwes during the 1946 fiscal year through the operations of the Oregon and Cal fornia Revested Lands Administration of the General Land Office Developments during the year included the holding of public hearings fo the establishment of a greater degree of cooperation in the handling of th natural resources so vitally essential in the postwar period. At the sam time, mutual negotiations between the Federal and State Governments an private citizens resulted in the furnishing of more than 345,000,000 boar feet of timber, most of which went to meet the Nation's constructio demands, with a resultant revenue of more than $1,420,000 from the sales o these resources in the area.

"How long will my job last? Will my children's future welfare b assured by the timber supply in our vicinity? Can the prosperity of ou community be maintained for an indefinite length of time?" These thre questions long have mirrored the fears of the forest products industr throughout the world. At some stages in American history an irrevocabl negative answer produced bare areas denuded of trees, "ghost" towns, an the resultant wreckage of local economic units which the Nation could il afford to bear.

Government and industry alike have recognized that sustained yield oper ations—the maintenance of a reasonable balance between the volume of tre cutting and tree growing—hold the only satisfactory answer to the problem Each has striven to put such a program into actual practice in its own fiel of endeavor and in so doing has pointed the way to greater cooperatio between the two for the benefit of all. The extent to which this cooperation can be made to work for the stabilzation of the industry and its dependent communities has nowhere been so strikingly demonstrated as in wester Oregon where Federal lands, privately owned, State and county-owned lands are intermingled to form what is in effect the world's largest experimenta laboratory in practical forest management. The administration of thes "O. and C." lands by the General Land Office formed the outstanding feature of the Nation-wide program of conservation of natural resources of the Department of the Interior during the fiscal year.

Presenting one of the most complex problems in forest management in the entire field of forestry, the area, 300 miles long and 60 miles wide, extending through 18 western Oregon counties from the Columbia River to the California State line, includes more than 8,000,000 acres of forest lands located in the very heart of the famous Oregon Douglas fir belt. With ownership of the lands scattered through eight different types of holdings, of which private and county owned lands combined comprise 52 percent of the total, the 2½ million acres of public land under the jurisdiction of the

General Land Office constitute the foundation upon which the far-seeing program for mutual cooperation in sustained yield forest management activities is based.

Incidentally, the history of these "O. and C." lands is of itself an interesting chapter in the economic advancement of the Pacific Northwest. Prior to 1866, practically all of these lands were public domain but in July of that year a grant was made to the Oregon and California Railroad Co. to aid in building a railroad from Portland, Oreg., to the California State line in connection with the Central Pacific Railroad. Subsequently the grantees failed to live up to the provisions of the grant and the lands ultimately were ordered revested in Federal Government ownership. In 1937, Congress enacted a law providing for the installation of a sustained yield forest management plan in the area. The Oregon and California Revested Lands Administration was established in Portland, Oreg., by the General Land Office to administer this law.

While progress on the administrative features of the program was retarded during the war years, timber from the "O. and C." areas formed an important element in the supply of forest products essential to the conduct of military activities.

With the cessation of active hostilities opportunity was afforded to carry forward the program of cooperation between the Government and its citizens in negotiations which formed the highlight of activities during the 1946 fiscal year. As a consequence hearings were held at Eugene, Oreg., in December 1945 on plans for establishment of the first of 12 proposed master economic units in which sustained yield timber cutting and appurtenant marketing operations would be carried on for the benefit of the industry and communities directly concerned.

In addition to the administration of the balanced tree cutting program, other factors in beneficial land use under national conservation were included in the record of accomplishments for 1946. Among these were a study of damage done by deer to tree plantations in the area, and experiments in the seeding of burned forest tracts by airplane.

Beneficial use of the land in the revested "O. and C." areas, other than for sustained yield timber cutting operations, was provided in 1946 under the work program of the administration. For example, more than 230 leases for the grazing of livestock on the lands were issued during the year. Altogether almost 350,000 acres thus were made available for the grazing of more than 28,000 animals on areas where such use would not interfere with forest production. The program also involved the setting aside of appropriate tracts in the area for recreational purposes.

Alaskan Fire Control Service

Maximum beneficial use of the supply of forest products on the public lands in Alaska is a problem of outstanding importance in the economic development of the Territory. The responsibility for timber managemen and prevention and suppression of forest fires on the public domain area are tasks handled by the Alaskan Fire Control Service of the General Lan Office. During the past fiscal year the Service was charged with the responsibility for fire protection on more than 225,000,000 acres of fores brushland or other vegetated areas.

Of the 124,431 acres depleted by fire during the 1946 fiscal year, 3 percent was caused by lightning, 18 percent by smokers, 30 percent b debris burners and campers, and the remainder by other miscellaneou causes.

In addition to its educational campaign for the prevention of fires i Alaska and the suppression of such conflagrations as its limited personnel an fire-fighting facilities will permit, the Service was made responsible for th handling of timber sales from public lands in the Territory.

This responsibility, transferred from the Branch of Field Examinatio under a program which recognizes the relativity of management as part o the general timber administration program in Alaska, is expected to form major factor in the work program during the coming year.

Surplus Real Property

One of the responsibilities placed upon the General Land Office in 1946 following the termination of the war, was that of the disposal of grazing an mineral lands and certain other types of real property declared to be surplu upon the expiration of its value for miltary use. Up to June 30, 1946, 2 declarations of surplus property for handling by the appropriate divisio in the office involved properties in continental United States, valued a $53,606,815, while 12 declaration in Alaska had a total value of $23,770, 058, the total of all such property placed with the office for disposal during the fiscal year being $77,376,873.

Military use of the lands in the United States during the war period included reallocation of areas for three air fields, seven Japanese relocatio centers, three recreational areas, one prisoner-of-war camp, a bombing target, arsenal plant, sawmill, and ordnance depot. All of the areas in Alaska were set aside for army installations. At the end of the fiscal year disposal by sale and transfer had been consummated in the amount of $238,419, al involving property within the United States.

The Public Lands

Area of the public lands.—The area of public lands remaining in Federal ownership, including Indian trust and tribal lands, as of June 30, 1946, amounted to about 413 million acres in the public land States and about 365 million acres in Alaska. Approximately 419 million acres of these public lands were vacant, unappropriated, and unreserved as follows: 37 million cres in the States outside of Federal grazing districts; 132 million acres ithin such districts; and 250 million acres in Alaska. During the year 01,000 acres were withdrawn for various public purposes while withdrawals serving 167,000 acres were revoked.

Of approximately 778 million acres remaining in Federal ownership in e State and Alaska, 117 million acres in the States and 363 million acres Alaska were still unsurveyed as of June 30, 1946.

The total acreage patented with minerals reserved to the United States as increased during the year to 48,863,127 acres as shown in the following able:

ABLE 1.—*Acreage of lands patented with minerals reserved to the United States as of June 30, 1946*

Type of mineral reservation	Patented during fiscal year 1946	Total patented through June 1946
	Acres	*Acres*
eservation of all minerals:		
Under Stock Raising Act	10, 774	33, 596, 826
Under other acts	76, 904	2, 453, 160
Total all minerals	87, 678	36, 049, 986
eservation of specific minerals:		
Coal	2, 437	10, 878, 052
Others [1]	6, 387	1, 935, 089
Total specific minerals	8, 824	12, 813, 141
Grand total	96, 502	48, 863, 127

[1] Includes coal reserved in combination with other minerals.

Leases and permits.—During the year an additional area of 1,960,543 acres was brought under lease, including mineral permits and licenses, making a total of 19,667,983 acres under lease at the end of the year. The types of leases in force June 30, 1946, are shown by the following tables.

TABLE 2.—*Mineral leases, permits, and licenses outstanding,[1] as of June 30, 1946*

Mineral	Leases		Permits		Licenses		Total	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Oil and gas	[2] 8, 750	6, 034, 396	--------	--------	--------	--------	8, 750	6, 034, 396
Coal	337	80, 080	79	78, 483	73	2, 894	489	161, 457
Sodium	3	1, 239	25	35, 269	--------	--------	28	36, 508
Phosphate	9	5, 031	--------	--------	--------	--------	9	5, 031
Potash	20	47, 292	7	17, 781	--------	--------	27	65, 073
Silica sands	2	400	--------	--------	--------	--------	2	400
Total	9, 121	6, 168, 438	111	131, 533	73	2, 894	9, 305	6, 302, 865

[1] Does not include permits granted to Federal War agencies.
[2] Does not include 21 leases (9,566 acres) within naval reserves.

TABLE 3.—*Leases other than mineral leases outstanding, as of June 30, 1946*

Type of lease	Number	Acres	Annual renta
Aviation	43	28, 776. 27	$525.
Fur farm (Alaska)	19	133, 810. 00	775.
Grazing (Alaska)	9	1, 168, 953. 93	1, 269.
Grazing (Oregon and California)	237	342, 910. 12	9, 814.
Grazing (Taylor Act, sec. 15)	10, 027	11, 660, 240. 22	235, 534.
Recreational	17	20, 003. 78	[1] 610.
Small tract	1, 952	9, 671. 04	[2] 9, 673.
Water well	15	600. 00	585.
Others	3	153. 01	10.
Total	12, 322	13, 365, 118. 37	258, 798.

[1] Does not include rental of 1 lease, the rental of which is based on receipts.

[2] Does not include rental of business site leases, the rentals of which are based on receipts.

In addition, 393,000 acres were being used at the end of the year by Federal and local agencies, private individuals, and corporations under permit from the Commissioner of the General Land Office. War agencies held departmental permits for the use of almost 23,000,000 acres of public lands.

TABLE 4.—*Entries and selections, fiscal year 1946*

Type of entry or selection	Original entries and selections [1]		Final entries [1]		Patents and certifications [1]	
	Number	Acres	Number	Acres	Number	Acres
Homestead entries:						
Stock raising	2	1, 276. 88	9	4, 925. 20	21	10, 773. 98
Enlarged	5	992. 86	4	843. 74	8	1, 827. 69
Reclamation	8	929. 78	[2] 180	22, 699. 43	125	14, 095. 60
Forest	6	571. 53	2	320. 00		
Commuted			[3] 4	240. 12	3	280. 12
Sec. 2289 R. S., et al	[4] 123	14, 489. 29	[5] 55	4, 477. 37	50	4, 317. 88
Total homestead entries	144	18, 260. 34	254	33, 505. 86	207	31, 295. 27
Other entries and selections:						
Desert land entries	4	427. 65	10	1, 304. 52	12	1, 855. 49
Public auction sales			104	10, 146. 73	133	10, 725. 13
Timber and stone entries	1	40. 00	1	40. 00		
Mineral entries	60	6, 976. 94	59	7, 712. 13	77	6, 837. 35
Indian selections			1	40. 00	249	560. 60
Miscellaneous cash sale entries	6	(6)	[7] 274	8, 653. 13	232	10, 022. 22
Exchanges					73	85, 553. 64
State selections	7	1, 731. 36			5	[8] 2, 172. 09
Curative and supplemental patents					174	(9)
Others	(10)	20. 00	3	82. 05	80	5, 050. 75
Total other entries and selections	78	9, 195. 95	452	27, 978. 56	1, 035	122, 777. 27
Grand total	222	27, 456. 29	706	61, 484. 42	1, 242	154, 072. 54

[1] An original entry or selection is one made in pursuance of an act of the Congress which prescribes the terms and conditions under which patent may be issued or other evidence of title granted. An original entry becomes a final entry upon compliance by the entryman with further requirements of the law, such as residence or additional payment, and upon the issuance of a final certificate. A final certificate shows that, in the absence of irregularity, the entryman is entitled to a patent and passes equitable title to the land to the entryman. Where upon final examination it is found than an entry or selection is in proper form and that the law has been complied with, a patent conveying legal title to the claimant is issued. In the case of certain State selections, the legal title is conveyed upon approval thereof by the Secretary of the Interior and upon certification by the Commissioner of the General Land Office.

[2] Includes 22 homesteads on ceded Indian lands (2,511.71 acres).

[3] Includes 3 homesteads on ceded Indian lands (200.00 acres).

[4] Includes 1 homestead on ceded Indian lands (39.81 acres).

[5] Includes 19 homesteads on ceded Indian lands (1.386.34 acres).

[6] Town lots upon which only part payment was made (area not tabulated).

[7] Includes 76 ceded Indan town lots (area not tabulated).

[8] Includes certificationis, 1,332.09 acres.

[9] Acreage previously reported.

[10] 1 selection was amended.

Homesteads, sales, and othe rentries.—The preceding table shows the new entries and selections allowed, the entries finally approved and the patents and certifications issued during the year. At the end of the year, 3,968 entries embracing 587,000 acres were pending awaiting further compliance with the public land laws by entrymen or final action by the General Land Office.

Land grants.—Title to 7,106 acres was conveyed during the year in satisfaction of grants of public lands made by the Congress to States and railroads for public purposes. Grants to States included 1,332 acres of indemnity school land selections, 760 acres of swamp land, and 80 acres selected for a State university. A total of 4,934 acres was patented to railroad companies pursuant to the Transportation Act of 1940.

A total of 182 applications for rights-of-way were approved during the year under laws which provide for the granting of rights-of-way over the public lands for telephone and telegraph lines, public roads, pipelines, and other purposes. Of the applications approved, 55 were permits or easements with an annual rental of $1,220 and 26 were temporary rights-of-way over "O. and C." lands with an annual rental of $485.

Land exchanges.—Exchanges of land with private owners and local governments resulted in the addition of 52,532 acres to grazing districts in exchange for 53,174 acres of Federal land; 5,224 acres to Indian reservations in exchange for 5,274 acres; 2,770 acres to the "O. and C." lands in exchange for 747 acres; 80 acres to a national monument in exchange for an equal acreage; and 110,086 acres to national forests in exchange for 26,278 acres of land and sufficient timber to equalize the values involved.

Receipts and expenditures.—Receipts from all sources during the year totaled $13,104,067.13. Mineral rentals, royalties, and bonuses accounted for 85 percent of the total receipts and sales of timber from the Oregon and California and Coos Bay lands for an additional 11 percent. The remaining 4 percent were realized from sales of public and ceded Indian lands, rentals, fines and penalties, copying fees, and from miscellaneous sources.

Of the total receipts, 37 percent will be distributed among various State and county governments and 45 percent will be covered into the reclamation fund. The remainder, except for $14,425.85 which will be credited to Indian trust funds and $56,926.34 will be credited to the range improvement fund, will be covered into the general fund of the Treasury.

Expenditures from appropriations amounted to $2,822,662, distributed as follows: general administration, $937,002; surveys, $515,332; field examination, $371,653; fire protection and timber management, $350,395; administration of the revested and reconveyed grant lands, $321,021; district land offices, $279,883; and range improvements, $47,376. Expenditures, aggregating $771,336, were made from funds transferred to the General Land Office as follows: for disposal of surplus real property, $504,985; Missouri River Basin project, $99,067; soil and moisture conservation operations, $91,161; white pine blister rust control, $60,543; Civilia Public Service program, $10,309; and Naval ordnance test station, $5,27

The following table shows the receipts earned during the year, by source and Treasury accounts.

TABLE 6.—*Disposition of receipts of the General Land Office,*[1] *fiscal year 1946*

Source of receipts	Covered into the Treasury earmarked for—				
	General fund	Reclamation fund	States and counties	Indian trust funds	Total
Sales of public lands	$43, 492. 42	[2] $80, 000. 00	[2] $3, 000. 00		$126, 492.
Fees and commissions	18, 375. 62	[2] 60, 000. 00			78, 375.
Mineral leases and permits:					
Mineral Leasing Act	1, 003, 259. 76	5, 266, 326. 23	3, 761, 661. 60		10, 031, 247.
Red River oil and gas lands			2, 815. 29	$4, 692. 16	7, 507.
Potash	78, 963. 75	[3] 471, 042. 83	296, 114. 05		846, 120.
Other	[4] 234, 310. 53				234, 310.
Total mineral	1, 316, 534. 04	5, 737, 369. 06	4, 060, 590. 94	4, 692. 16	11, 119, 186.
Oregon and California grant lands	667, 111. 75		667, 111. 76		1, 334, 223.
Coos Bay grant lands	91, 780. 10		[2] 15, 000. 00		106, 780.
Taylor Act gazing leases	56, 032. 11	[5] 56, 926. 34	112, 958. 46	1, 788. 49	227, 705.
Right-of-way leases	26, 162. 33	1, 638. 36			27, 800.
Sales of reclamation town lots		[6] 4, 900. 83			4, 900.
Sales of Indian lands				7, 945. 20	7, 945.
Copying fees	21, 416. 98				21, 416.
Other	49, 240. 18				49, 240.
Grand total	2, 290, 145. 53	5, 940, 834. 59	4, 858, 661. 16	14, 425. 85	13, 104, 067.

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[1] Before final settlement of all accounts by the General Accounting Office.

[2] Estimated.

[3] Includes $56,483.17 collected in California under act of Oct. 2, 1917 (40 Stat. 297).

[4] Includes $24,692.16 collected in Wyoming under act of June 26, 1926 (44 Stat. 1621), $188,196.48 collecte in California under Executive Order 9087 dated Mar. 5, 1942, $18,098.48 collected in Alaska, and $3,323. collected in Nevada.

[5] Range improvement fund.

[6] Includes $112.50 from sales of reserved reclamation lands.

Grazing Service[1]

C. L. FORSLING, *Director*

* * *

SATISFACTORY progress was made toward the achievement of most of the major conservation programs undertaken by the Grazing Service during the fiscal year 1946. These objectives were centered mainly on the most urgent problems of range administration in the several grazing districts, the success of which hinges on an equitable distribution of grazing privileges among the various users coupled with better management of the range itself. Included in the broad aspects of range management are the recurring jobs of range surveys, dependent property checks, and periodical review of previous actions pertaining to grazing permits, especially where former action on permits was based upon insufficient data to safeguard the interest of the Federal Government in this connection.

While the surrender of Japan brought a sudden reduction of certain essential war activities (such as the construction of access roads), the transition to increased peacetime activities enlarged the grazing district work in many directions. For example, the wartime military requirements for vast areas of grazing district lands for training and testing grounds relaxed considerably after the historic test of the atomic bomb in New Mexico on July 16, 1945. As a consequence, work on land matters as an element of postwar readjustment increased noticeably as the year advanced. The affairs of hundreds of people are involved in the 14 million acres of grazing-district lands which were used for military purposes—people who formerly had permits to graze these lands, or who otherwise had become "displaced persons" as a result of military needs in the areas. These circumstances required much study and attention on the part of Grazing Service officials in a number of grazing districts.

The proposed irrigation and basin development programs of the Bureau of Reclamation will affect practically all of the grazing districts in one way or another. In turn, the contributions which the watershed and forage-producing potentials of these districts make to the major program will be governed largely by the kind of management that these upstream areas receive. This called for general and specific investigations of the grazing district lands in the light of their condition and present occupancy to determine the proper place of the Federal range in the over-all basin program. Situations pertaining to streamflow, silt, and watershed conditions, and grazing needs, wildlife protection, and related matters were considered and reported upon for the use of agencies and individuals concerned.

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[1] On July 16, 1946, the Grazing Service was merged with the General Land Office by Executive order under the Reorganization Act of 1945. This order abolished the two agencies and placed them, together with their respective functions, in the Bureau of Land Management, Department of the Interior.

Range Administration

Range conditions generally were favorable during the year in most districts, exceptions being in the Southwest and the extreme north where drought persisted during most of the fiscal year. From the southern parts of Arizona and New Mexico the drought extended into adjacent areas in Utah, Nevada, and Colorado. In these areas shortages of range feed and deficient water supplies caused some losses and prompted the movement of many livestock to irrigated pastures, where available, and to distant grazing lands.

According to Weather Bureau records and experience, severe drought occurs on the western range lands about 3 years out of 10. During recent years, substantially coinciding with war years, the range lands within the Upper Colorado, the Upper Missouri, the Snake, and the Great Basin drainages have received better than average moisture. Generally speaking, forage and crop conditions have been good. The odds are against a continued period of "wet" years over this area as a whole. It is the aim of the Grazing Service to attain conservative stocking of the Federal range in order to have a carry-over of forage to cushion the "dry" years. Many operators support this view, although in the midst of consumer demand at high prices it is not surprising that some should insist on full harvest of the forage crop each year as a means to greater immediate returns. On the whole, the growers have cooperated fully by reducing numbers or holding the line against increasing numbers. Many have culled their herds of low-grade, unprofitable animals.

Increased activity in real estate transactions, involving sale of base property and the consequent requests for transfer of grazing privileges, created additional demands on the Service during the year. Range surveys to determine proper capacities of areas previously unsurveyed and re-examinations of certain areas were resumed after the return to duty of trained men who had been on military furlough. Original extensive surveys covered 3,340,354 acres and rechecks covered 4,412,286 acres. Both public and intermingled private grazing lands were involved. Of this total, 2,281,333 acres are within soil and moisture conservation project areas.

Certain controversies, centering on the questions of grazing capacities and proper use of base properties in several grazing districts, were resolved satisfactorily during the year. However, owing to the enforced wartime lapse of certain fundamental grazing district activities, primarily due to the absence of trained personnel who were serving in the war, there still remains much to be done in many districts before term permits and other objectives of the Taylor Grazing Act can be considered to be on a stabilized basis. Regulation of range use under the license and permit system has been a potent factor in promoting both conservation of the resources and stability in the western range livestock industry. Those who have base property and are licensed to use the range now have reasonable assurance that the proper share of forage will be available to them at the proper time. There is a pressing need for the completion of a comprehensive range appraisal to serve as a basis for determining a reasonable grazing fee to be charged for the use of the Federal range. Also, many areas presently underused and others overused, due to existing circumstances, need to be brought under proper use. This can be accomplished by more water development and other improvements on outlying areas that are now used only slightly, if at all. Such a program—estimates for which have been prepared—would aid immeasurably in relieving or abating damage on presently congested areas. Eroded lands and areas that were devastated of forage by fire should be rehabilitated, and on such areas adequate means for the control of both livestock and wildlife are necessary.

Licenses and permits.—A total of 9,397,756 livestock grazed the Federal range under permits and licenses during the year, representing a net reduction of 621,422 head as compared to the previous year. Most of this reduction was in sheep which showed a decrease of 671,568 head. Cattle numbers increased 68,326 head. The number of licensed operators was reduced slightly from 21,650 to 21,329. The statistical detail is shown by regions in table 1. Weights of marketable livestock as well as numbers marketed from the Federal range were above average. Favorable conditions in the northern regions influenced this situation where better lamb and calf crops prevailed.

TABLE 1.—*Number of licensed operators and livestock in grazing districts by regions, June 30, 1946*

Region	Licensed operators	Cattle	Horses	Sheep	Goats	Total livestock
Arizona	563	87, 572	2, 102	61, 585	8, 934	160, 193
Colorado	2, 100	189, 520	6, 666	767, 580	154	963, 920
Idaho	3, 269	235, 280	15, 766	963, 139	15	1, 214, 200
Montana	3, 118	295, 457	22, 978	916, 912	32	1, 235, 379
Nevada, California	1, 573	444, 288	17, 578	791, 253	2, 601	1, 255, 720
New Mexico	3, 921	280, 960	14, 263	587, 238	41, 961	924, 422
Oregon	1, 473	237, 037	12, 575	240, 527	------------	490, 139
Utah	3, 898	196, 280	6, 609	1, 506, 385	5, 050	1, 714, 324
Wyoming	1, 414	178, 378	10, 331	1, 250, 725	25	1, 439, 459
Total	21, 329	2, 144, 772	108, 868	7, 085, 344	58, 772	9, 397, 756

Wildlife.—Big game in grazing districts decreased about 2½ percent, totaling 569,186 head, as compared to 583,432 head the previous year. The largest reduction was in antelope, there being 19,434 fewer such animals. Deer increased 4,291 head and elk increased 895 head. Game-management plans were formulated in cooperation with State agencie aimed at breaking up the concentrations of game where such conditions ar a detriment to both range and wildlife. Certain transplanting was accomplished with success. Water developments of special types and othe range improvements made possible by the Pittman-Robertson Act hav been very beneficial to the welfare of upland birds and big game in grazin districts. Wildlife representation on advisory boards is helpful in th solution of game problems. This type of activity was extended to regiona and national levels during the year, wherein wildlife problems of genera concern are discussed and solutions sought. One of the first results o such discussions was the establishment of bag limits and hunting dates i certain States for the current season, area by area, according to prevailin conditions, as recommended by the wildlife committees. Cooperative activities looking to better wildlife conditions in grazing districts were extende in a number of localities during the year.

Range studies.—Field studies to complete the inventory of resource under Grazing Service administration were pursued so far as available fund would permit. Procedures incident to the increasing number of permi transfers resulting from sales of ranch base property were reviewed preparatory to reducing paper work entailed by such transactions. Field work in a number of districts was directed toward getting more authentic information on actual use of the range to serve as a recheck on the forme grazing capacity estimates. This, in turn, will form the basis for making the necessary adjustments in authorized range use in those areas.

A number of cases involving grazing permits of some years' standing were reviewed during the year. As a whole this review centered on the question of compliance with the Federal Range Code which provides in part: "To promote the highest use of the public lands within grazing districts which have been or hereafter are established, possession of sufficient land or water to insure a year-round operation for a certain numbe of livestock in connection with the use of the public domain will be require of all users." Four main points are stressed in this connection: (1) The permittee must own (or control through acceptable lease) adequate property which is qualified by dependency by use to the extent of the base property requirement of each area in which he has grazing privileges; (2) the available Federal range must have been adjudicated proportionately among all qualified applicants according to their respective qualifications; (3) the total grazing privileges granted in a unit or allotment must be within the grazing capacity of the area; (4) all permittees must possess sufficient land and water to insure a year-round operation for the permitted number of livestock. This procedure resulted in better coordination among district graziers and the advisory boards and the amendment of current 10-year grazing permits in a number of cases. During the period of this review it was necessary to suspend the issuance of term permits until he latter part of the fiscal year, and this job, involving nearly 22,000 livestock operators, is now about two-thirds completed.

Cooperative studies with the Oregon State Agricultural College at the Squaw Butte-Harney Range and Livestock Station continued during the year with emphasis being placed upon the effects of controlled range management on livestock husbandry and natural reproduction of native vegetation. Studies at this station are applicable to large areas of surrounding Federal range in four States. Studies to determine practical answers to the problems of rotation grazing, mineral deficiencies in native forage, and proper seasons of use over widely scattered areas were conducted in cooperation with individual permittees. Cooperation was continued with the University of Wyoming on the Church Buttes and Hadsell area studies. In the latter case an effort is made to determine the effect of supplemental feeding of sheep on mineral-deficient winter ranges. At the Church Buttes station records are being kept on dual use of selected ranges by cattle and sheep to determine questions of range management in areas where the two classes of stock compete for the same range.

Trespass.—Enforcement of the rules of the range was handicapped to some extent by manpower shortages. Complaints were investigated so far as possible, but it was impossible to apprehend all offenses. Trespass action was taken on 132 cases in which voluntary propositions of settlement for damages to the United States were accepted. Five cases of willful violations were turned over to the Department of Justice for jurisdiction in Federal courts. Removal of surplus trespassing horses mainly through private enterprise and voluntary action of permittees continued but on a reduced scale from that of previous years and indications are that the program inaugurated in 1943 to rid the range of "star boarders" is bringing satisfactory results. Notable success was reported from Wyoming and Montana grazing districts. An effort was made to encourage disposal of such animals to the war-devastated countries of Europe to help relieve shortages of farm animals and protein food supplies in those areas. The diversion of surplus horses from the range into useful channels in this way helps to conserve the forage and rehabilitate war-torn people.

Hearings and appeals.—On July 1, 1945, there were 89 pending appeals from decisions of district graziers, carried over from the previous year. During the 1946 fiscal year 96 additional appeals were filed and hearings requested, making a total of 185.

There were 77 appeals disposed of during the fiscal year. Hearings were held in 37 cases; 22 were settled by the examiner, or were withdrawn after being set for hearing; and 18 were withdrawn or settled by stipulation in the field. From the decisions of the examiner in 37 cases, 7 were appealed to the Secretary. Of these seven, one was withdrawn before a decision was rendered by the Secretary, decisions were rendered in four cases, and the decisions on two cases are pending.

A review of past years' hearings work indicates that the number of appeals filed in 1946—96 in number—is an all-time low. As of July 1, 1946, there are 108 pending appeals.

Land Planning and Utilization

During the fiscal year 1946 the Grazing Service administered 60 grazing districts, with a gross area of 264,609,700 acres. Of this total approximately 145,777,000 acres are Federal range and the remainder is mainly in private, State, and county ownership. Approximately 14,000,000 acres of the Federal range area is public land in certain withdrawn status but administered by the Grazing Service under cooperative agreements with other Federal agencies. Pierce Act leases in 6 States totaled 1,053,200 acres, and the area withdrawn by establishment of grazing districts totaled 130,683,965 acres.

Military uses of grazing district lands.—Military requirements for land uses in grazing districts took a sudden downward trend following the successful test of the atomic bomb. This test took place in July 1945 on the Las Cruces-Alamogordo bombing range within New Mexico grazing district No. 4 (Tularosa). VJ-day, which followed within 2 months of this momentous occasion, hastened the return of American fighting forces from all corners of the world and the ultimate reconversion of millions of acres of grazing lands from war to peacetime pursuits.

As a result of revocation of a number of withdrawals and special land-use permits, the total area of public land used for military purposes has been reduced from a wartime peak of 14,428,919 acres to 6,533,461 acres on June 30, 1946. This reduction is due largely to the revocation of several large special-use permits involving land used temporarily for maneuvers in Oregon and Arizona. Since substantially all of the withdrawals and special land-use permits provide for the return of the administration of the lands to the agencies under whose jurisdiction they were administered prior to the war, it is anticipated that a large part of the land ultimately will be placed under grazing administration.

Plans for the administration and restoration of such lands were formulated during the year. Large areas will need to be rehabilitated. It is estimated that nearly 2 million acres of public lands temporarily set aside for military uses will require rehabilitation as a result of such activities. Private lands within grazing districts that were purchased by the military establishments, if returned to private ownership, will need to be considered in connection with other land problems in grazing districts. It is the belief of the Grazing Service that substantially all of the public lands in grazing districts which have become, or are about to become, surplus from a military standpoint are suitable for administration under the Taylor Grazing Act for grazing, watershed, and other purposes.

Land plans.—Lands now used for military purposes when restored to grazing use will be included in the over-all land planning program which seeks to simplify the ownership pattern in grazing districts and the administration of public lands. Simplification of the pattern can be achieved through exchanges, leasing under the Pierce Act, exchange of use, cooperative agreements, sale of isolated tracts, development of selected tracts under basin programs, and modification of grazing-district boundaries.

Land plans to accomplish the above objectives have been formulated and are now under consideration in 14 areas, some of which involve entire grazing districts. This has had a tendency to push the exchange of lands with States looking to the mutual advantage of the States and the Federal Government. Land planning in grazing districts contemplates better administration and utilization of all the associated lands in the area, including grazing, recreation, wildlife conservation, and watershed protection.

Drainage basin studies.—Studies of grazing-district lands within the Arkansas, Bonneville, Colorado, Columbia, Lahontan, Missouri, and Rio Grande basins were conducted in connection with the proposed basin development programs in accordance with the interagency plan sponsored by the Bureau of Reclamation. Investigations designed to fit the use and management of grazing lands of the Upper Missouri basin into the broad basin development program were pursued in 11 grazing districts involving 13½ million acres of the Federal range.

Reports covering range, watershed, and livestock situations in grazing districts within the seven drainage basins were submitted to the Bureau of Reclamation to be incorporated into plans for basin-wide studies. Substantially all of the land under Grazing Service administration is embraced within the drainage basins mentioned. Future irrigation and flood-control projects therein must essentially take into account the grazing lands and the associated base properties that will affect and be affected by the basin programs. Field investigations will be required in order to resolve local problems and harmonize basic policy. This work will involve close coordination of all land use in the areas and full cooperation to attain full benefits from the land and its resources on a sustained-yield-conservation basis.

Land classification.—At the beginning of the year 395 individual land cases were pending within grazing districts under sections 6, 7, 8, and 14 of the Taylor Grazing Act, the 5-acre tract law of 1938, and other public-land laws. A total of 714 new cases was received during the year and 783 disposed of, leaving 326 pending at the close of the year.

Administrative Management

The Service continued to be handicapped by abnormal turn-over in personnel occasioned by the close of the war. Of the 204 employees on military furlough at the beginning of the year, 107 returned to duty, 7 requested extended leave without pay, 31 were separated by resignation or otherwise, 3 were killed in action, and 56 were still on military duty at the close of the year. Many of those with military-preference rights, along with others, were separated during the final week of the fiscal year by reduction in force due to curtailment of salary and expense funds for the fiscal year 1947. This curtailment placed a limit on the number of persons to be employed on the salaries-and-expenses rolls, requiring a reduction of 79 percent in civil-service employments. To meet this situation, it was necessary to abolish certain important functions and to separate about 200 employees, some of whom had had more than 20 years of faithful Government service and others who had barely been reestablished in their former positions after military service of from several months to several years.

Since grazing-district work consists primarily of action programs on the ground, the field coverage of such activities was disrupted, many field stations necessarily closed, and four regional headquarters abolished on June 30, 1946.

A small number of pieces of automotive equipment and other heavy equipment were obtained by purchase from surplus disposal agencies. However, this was not nearly enough to effect any material replacement of worn out units. Expenditures for upkeep of old equipment for which there have been no replacements during recent years have exceeded value received, but there appears no alternative if the demands occasioned by emergency fire fighting and other work in grazing districts are to be met.

Administrative audits and grazing-district inspections were confined to absolute minimum requirements due to personnel shortages. The audit program is badly in arrears because the one qualified auditor has been occupied almost full time on other pressing work. For efficient business administration it has been shown that the regional offices should be covered by an audit at least once each year.

Steps were taken during the year to reduce the regional offices from nine to five for purposes of economy, and efforts were made to put more personnel on the ground where grazing control and the protection of natural resources need to be strengthened.

Grazing Service employees purchased $164,950.79 (purchase price) worth of war and victory bonds during the fiscal year 1946 through the pay-roll deduction plan. Withholding taxes aggregated $167,225.67.

Appropriations and allotments.—Administrative funds provided by the Congress for the fiscal year 1946 totaled $1,121,470. In addition, $115,000 was appropriated for the construction and maintenance of range improvements, and $7,500 for leasing of lands under the Pierce Act. Allotments for fire protection and for soil and moisture conservation work totaled $585,750.

Thes following working funds were transferred to the Grazing Service during the fiscal year 1946 for the performance of work assigned on specific projects:

From the Public Roads Administration for the construction and maintenance of access roads to mineral deposits and other strategic materials	$246, 569
From the Bureau of Reclamation for use in the Missouri River Basin studies	10, 300

Funds transferred from the Public Roads Administration during the 4-year period ending June 30, 1946, total $3,138,069.

Grazing fees.—The earned grazing fees in the grazing districts during the fiscal year 1946 aggregated $736,266.70, by States as follows: Arizona, $32,557.62; California, $20,139.11; Colorado, $46,416.04; Idaho, $69,877.25; Montana, $62,872.06; Nevada, $114,487.08; New Mexico, $103,542.47; Oregon, $59,354.14; Utah, $125,844.08; and Wyoming, $101,176.85.

Of this amount, $231.84 was deposited to the credit of the Indians and $368,017.46 was paid to the States affected under the provisions of the Taylor Grazing Act, bringing the total state revenues from this source to $3,812,650.04 during the 11-year period 1936–46.

Contributions received.—Contributed funds in the aggregate amount of $67,505.24 were accepted under section 9 of the Taylor Grazing Act from 8 of the 10 States in which grazing districts have been established. These contributions are listed by States as follows: Arizona, $1,458.25; Colorado, $17,718.80; Idaho, $14,984.44; Montana, $7,737.89; Nevada, $6,857.71; Oregon, $1,808.15; Utah, $7,500; and Wyoming, $9,440.

The amount of such contribution since the inception of grazing-district administration totals $730,632.14.

Range Improvement and Maintenance

Range improvements, consisting primarily of water developments, truck trails, fences, bridges, corrals, cattleguards, and related facilities that have been placed on the Federal range at public expense since the inception of grazing-district administration, had an estimated residual value of $10,000,000 on June 30, 1945. Certain additional facilities were installed during the fiscal year 1946 but, due to many limiting factors, chief of which were the shortages of funds and equipment, it was necessary to stress the maintenance of existing projects and minimize the program of new construction. Contributions, mainly in the form of labor and materials by individual stockmen and the advisory boards, supplemented regular appropriations and, to an important extent, aided in the conservation and development program of the Grazing Service. New construction, financed largely from contributed funds, included completion of water developments previously undertaken, fencing, truck trails, stock trails, and driveways to facilitate better use and management of the range. Funds appropriated for range improvements and maintenance amounted to only about 1 percent of the capital value of structures needing maintenance. Consequently the needed upkeep of many important structures and other installations had to be neglected. Improvement projects on the Federal range that should be maintained in the public interest are of wide scope and variety, although there are others of equal importance to conservation but of direct benefit to individuals on which the cost of upkeep should be assumed by the stockmen who use them. A summary of range improvements with accumulative totals is shown in table 2.

TABLE 2.—*Cumulative summary of range-improvement projects in grazing districts, 1935–46*

Type of project	Unit	Completed fiscal year 1946	Total completed or acquired from Apr. 1, 1935, to June 30, 1946
Spring developments	Number	34	2,117
Reservoirs (stock water)	do	376	3,843
Wells (stock water)	do	53	877
Pipe and tile lines	Miles	6.8	70.1
Ditches	do	------	58.5
Truck trails	do	267.9	[1] 10,784.5
Stock trails	do	24.8	1,705.2
Stock driveways	do	15	1,486.9
Bridges, livestock (over 20-foot span)	Number	------	69
Bridges, vehicle (over 20-foot span)	do	1	113
Fences	Miles	327.1	7,463.7
Corrals and holding traps	Number	18	464
Cattle guards	do	34	770
Dipping vats	do	1	8
Telephone lines	Miles	------	380.7
Firebreaks	do	458	4,571
Boundary marking	do	85	4,814.5

[1] Includes access-mine roads.

Under section 4 of the act, 590 permits were issued to range users during the year to construct and maintain range improvements in grazing districts, bringing the total of such permits issued to date to 4,514. Construction permits within this provision totaled 401 for the period of this report involving improvements valued at $260,724. Maintenance permits issued in 1946 covered 189 existing privately owned facilities valued at $1,175,345, and used in the care and handling of permitted livestock.

Soil and moisture conservation.—Special attention was given to "sore-spot" areas through the soil and moisture conservation program authorized by Reorganization Plan No. IV of 1940. Areas that were seriously denuded and eroded before the passage of the Taylor Grazing Act were given artificial treatment so far as facilities would permit. Natural recovery in some areas has resulted from controlled grazing, while on many other areas the top soil had already been destroyed and erosion had progressed so far that grazing control alone is inadequate to restore the land to a stable soil and vegetative condition. Soil and moisture conservation work was conducted on 120 projects during the year, an increase of 6 over the previous year.

In the restoration of depleted areas, the watering places are closed during the growing season and drift fences are constructed for more positive control. Attention is then directed to the maintenance needs of areas that are in fair to good condition, as well as to the corrections necessary to restore depleted areas. In relieving the congested areas, care is taken to avoid overgrazing of adjacent lands. This requires systematic field checks to segregate areas overgrazed as compared to areas lightly used and unused and to appraise progress and methods. ·Needed improvements to gain effective control and rehabilitation are studied as a basis for future action.

Six major types of work were conducted with encouraging results on soil and moisture areas within grazing districts during the year. These include water development and maintenance, fencing, contouring, brush control, rodent control, and reseeding. Of the 32,842 acres reseeded during the year, 22,957 acres are within approved soil and moisture conservation areas. Water-development and maintenance work involved 201 units, and rodent control was conducted on 13,764 acres.

Access roads.—The access-road program, to facilitate war production of strategic materials, was virtually brought to a close during the year. Two projects remained to be completed. A total of 78.8 miles of such roads was constructed during the year, bringing the total to 1,975 in 4 years by States as follows: Arizona, 196; Colorado, 335.4; Idaho, 79.5; Montana, 96.3; Nevada, 167.4; New Mexico, 149.2; Utah, 885; Wyoming, 66.2. Considerable mileage is of permanent nature and is now serving in important industrial and administrative capacities. Some feasible provision is necessary for future maintenance of these feeder lines in the general interest of the vast area which they serve.

Fire control.—There were 606 reportable fires on the Federal range during the 1945 calendar year, resulting in a burn of 653,961 acres, of which 511,370 acres are Federal range and 142,591 acres are intermingled State and private lands. The average area burned yearly in grazing districts during the past 5 years is 1,075,800 acres, about 70 percent of which is Federal range. Damage consisting of forage losses, cost of reseeding devasted areas, woodland and timber values destroyed, watershed depletion, soil and moisture losses, livestock losses, and the replacement of destroyed range improvements is estimated at $1,735,627 for the year ending December 31, 1945. (Fire records are kept on a calendar year basis to conform with those of cooperating agencies.)

About 73 percent of the fires were man-caused, which stresses the need for vigilance and education in prevention of fires. More than 95 percent of the Federal range acreage burned in 1945 is in Oregon, Idaho, Nevada, and California, where devastation of the range threatens both private and public property of inestimable value, in addition to damage in the burned areas.

During the past year the cooperating States have been encouraged to continue the forest and range fire-fighting organizations set up under the wartime office of civilian defense plan. Notable progress was achieved in Nevada, Utah, and Montana. Cooperation with all other Federal agencies was renewed and continued and, in the case of Idaho, an effective agreement was entered into with the State wherein State and Federal lands in grazing districts are given additional protection through State contributions.

An analysis of the range-fire situation has brought to light a number of conclusive facts, among which are: (1) The need for more funds for presuppression work. Costs have increased enormously in recent years. (2) The need for more fire equipment to prevent and control fires. (3) Additional permanent fire-control personnel, well trained, and adequately equipped. Due to the many handicaps occasioned by equipment and personnel shortages, parched ranges, and added fire hazards, the outlook for 1946 is far from good.

Safety.—In the operation of 431 motor vehicles under Grazing Service responsibility, involving a total mileage of 3,497,674, there were 9 accidents, none of which were fatal to life. Damage to Government vehicles totaled $1,103 and to private property $82.50. In the operation of all kinds of equipment, including automotive, 41 accidents were reported, of which 26 were only minor and 15 caused lost time totaling 370 man-days. Thirty-two of the accidents occurred on construction work.

Fish and Wildlife Service

ALBERT M. DAY, *Director*

THIS report on the status of the wildlife resources of the Nation seeks to show how these resources have been affected for good or ill by the years of war. It seeks also to make clear how the activities of a Nation reconverting to peace can disturb the delicate balance between all the birds, fishes, mammals, and other wildlife and their environment, and to show what we must do to maintain a favorable balance.

In some respects, peace can be harder on wildlife than war. Whatever unfavorable elements the war years introduced, such as increased pollution of waterways, they at least resulted in a temporary reduction in hunting and fishing, giving wildlife populations some opportunity to restore past losses. But this respite came to an end even before the termination of the war, with a sharp upturn in the number of licenses issued to hunters and anglers, and clear indications that within a few years the number of sportsmen may be double the prewar figure.

Not only will there be more gunners and fishermen in the field, but wilderness areas that have hitherto been natural and almost inviolate sanctuaries for wildlife will become more and more accessible through all the devices of a modern, mechanized civilization. Moreover, the large scale development of the Nation's river systems, substituting an artificial environment of dams, impoundments, and irrigation ditches for the natural one of river bottomlands and marshes, demands the most careful planning and the most unremitting effort if the effect upon wildlife in these areas is not to be serious and irremediable.

As the wildlife resources, with all their inherent recreational, economic, and social values, are the property of all the people, so the task of preserving, rebuilding, and developing these resources is a public responsibility. With certain exceptions, the actual administration of the wildlife resources is carried out by the Governments of the various States. The function of the Federal Government in this field is to carry on, independently or cooperatively, the fundamental research needed to give direction and meaning to wildlife restoration programs, to carry out cooperatively with the States specific control or management programs, and for such resources as the Alaska fisheries or the migratory game birds, to manage these resources for the public benefit.

Status of Migratory Game Birds

Of all the migratory game birds sought by United States hunters, waterfowl are the most important from the standpoint of their number, their wide distribution, and the fact that they are hunted by more sportsmen than any other birds. Nevertheless, the population of ducks and geese has been declining since 1944. By the spring of 1946 this decline had assumed such proportions as to be considered alarming.

The continental population of waterfowl reached its lowest point in 1934, when it was estimated to total 27,000,000 birds. As a result of drastic curtailment of hunting privileges, coupled with improvement in conditions on the breeding and wintering grounds of the birds, the waterfowl population thereafter gradually increased, numbering 125,000,000 by 1944.

A reversal of this favorable trend first became apparent in 1945, when the annual inventory of waterfowl, taken each year in January, indicated a population of only 105,000,000 birds. This decline was confirmed by observations of the spring and fall migrations in 1945.

The January 1946 inventory, conducted by the same methods that have been used in each of the annual surveys, had the benefit of exceptionally good coverage, both surface and aerial. The planes and surface craft belonging to the Service were supplemented by those belonging to the States, the Coast Guard, the Naval Air Service, and the Army Air Forces. The results showed additional heavy losses, indicating a total continental population of approximately 80,000,000.

An analysis of inventory results showed that, with only two exceptions, all species of game ducks had suffered losses. The exceptions were the black duck or "black mallard," which was recorded in about the same numbers as in 1945, and the blue-winged teal, which showed a slight increase. These bright spots, however, were completely obliterated by losses among such favorites as the mallard, pintail, green-winged teal, scaups, redhead, and canvasbacks. Among the geese, although the blue goose, cackling goose, and both species of brant registered gratifying increases, these were largely offset by losses suffered by the more popular Canada and white-fronted geese. The status of the Canada geese in the Mississippi Flyway was found to be so seriously impaired that complete closure was announced for the 1946 season in Alexander County, Ill., with the recommendation that the entire flyway be closed to the hunting of this species.

Study of reports covering the spring migration of 1946 provides additional verification of the results obtained from the January inventory. On a percentage basis, 28 percent of the observers reported no change, 11 percent noted an increase, while 61 percent recorded a decrease. Comparable percentage figures for the spring migration of 1945 were 36, 28, and 36; those for the spring migration of 1944, 34, 54, and 12.

Among game birds other than waterfowl, some species were in satisfactory abundance while others declined or showed little change.

Studies of check breeding areas of the woodcock in New Brunswick, Nova Scotia, Prince Edward Island, Maine, and Pennsylvania indicate that this species is holding its own. On some of the areas an increase of 2 or 3 percent was recorded.

Wilson's snipe continued to be a problem species. Despite the fact that it has had full protection for several years, it continued to lose ground until 1945 when, on a Nation-wide basis, a slight gain was recorded. Most of the reports of increase have come from Louisiana and Florida where winter concentrations are found. The problem of proper management of both the woodcock and Wilson's snipe is most complex, apparently involving factors not well understood at present.

The production of mourning doves during the 1945 season was normal, and it would seem that this species has now largely or fully recovered from the heavy losses that resulted from the severe winter of 1940. Nevertheless, sound management principles based on scientific findings must be applied to this species if its status as a popular game bird is to be maintained.

A biological study of the white-winged dove in Texas and Arizona has been carried on for several years to provide information needed for maintaining this species. Despite a very short open season provided for the Lower Rio Grande section, the 1945 kill in Texas was entirely too heavy, amounting to 40 or 50 percent of the entire population of the Rio Grande Valley. With no increase of brood stock, and the continued clearing of the nesting habitat, it is obvious that drastic measures may be necessary to protect this bird in that region. Fortunately the status of the white-wing in Arizona was about normal, but here the total kill by hunters is much less, chiefly because the birds are dispersed over wide areas. A check during the hunting season showed that about 92 percent of the birds taken in Arizona were of that season's crop.

In 1945 the band-tailed pigeon was found in fair numbers locally throughout the Pacific coast region. Some increase was recorded in Colorado and probably also in New Mexico. A recent report from the State of Washington indicates that these birds have suffered considerable losses, probably due to unsportsmanlike methods of hunting that are in vogue in some places in the Pacific Coast States. Normally, these birds lay but one egg, so populations may be decimated in a single hunting season. A comprehensive report on the conservation and management of this species is in the process of publication.

The status of the sora and other rails is considered satisfactory.

Reports on the numerical status of the coot indicate a decreased population.

National Wildlife Refuges

All the forces of modern civilization—the growth of cities, the expansion of industries, the harnessing of waterways for power and irrigation, the expansion of highways and airports—normally work to reduce the land and water areas that are suitable for wildlife. To balance this tendency, a variety of land and water areas must be set apart and maintained for the primary purpose of providing for the needs of wildlife. The national wildlife refuges administered by the Fish and Wildlife Service are such areas. They are an indispensable tool in managing and maintaining wildlife in our modern world, at best a difficult one for the creatures of land and water.

Although the basic idea of wildlife refuges was conceived early in the present century, the modern refuge system has been in existence only about 10 years. This system of refuges has rendered an inestimable service by protecting wildlife from the danger of severe reduction or extinction, thus preserving for the public the economic, esthetic, and social values inherent in the possession of this living resource.

The importance of maintaining and enlarging the national wildlife refuge system as a stabilized protective measure for wildlife is emphasized by the sharp reduction in the continental population of migratory waterfowl that has occurred since 1944. It is estimated that at least one out of every five ducks, geese, and swans in North America uses these refuges at some time during the year, finding in them protected nesting, feeding, and resting areas.

The number of national wildlife refuges now administered by the Service is 291 (17,819,495 acres) (table 1), of which 271 (9,889,856 acres) are in the United States and 20 (7,929,639 acres) in Alaska, Hawaii, and Puerto Rico.

The Migratory Bird Conservation Commission approved the purchase of 22,796 acres of land in 13 units during the year. One of these was a new refuge and the remaining purchases were for consolidation of existing ones. In addition, the Commission approved the lease of 318,528 acres of land in three units, two of which involved the establishment of new national wildlife refuges. The Commission's approval of the purchase of 11,275 acres of land in the Laguna Atascosa area in Texas establishes a long needed refuge in that important waterfowl wintering ground. The two new refuges on leased lands are the large Everglades section of southern Florida, and the area around Sanibel Island on the western coast of Florida. The Sanibel National Wildlife Refuge, containing 2,394 acres in Lee County, Fla., was secured by lease on December 1, 1945, from the State of Florida. This is probably the best area north of the Everglades for the roseate spoonbill, black-necked stilt, man-o-war bird, and other rarities.

Executive orders were promulgated establishing two new refuges. The Theodore Roosevelt National Wildlife Refuge was established on 61,539 acres of land in Billings and McKenzie Counties, N. Dak., formerly under jurisdiction of the National Park Service. The Tennessee National Wildlife Refuge was established on 54,365 acres of land in Benton, Decatur, Henry, and Humphreys Counties, Tenn., acquired by the Tennessee Valley Authority for its Kentucky Dam and Reservoir project on the Tennessee River.

Public land orders were issued establishing two new refuges, the Tishomingo National Wildlife Refuge on 13,449 acres of land in Johnston and Marshall Counties, Okla., and the Hagerman National Wildlife Refuge on 11,429 acres of land in Grayson County, Tex. The lands embraced in the two units were acquired by the War Department for the Denison Dam and Reservoir project on the Red River. These two areas provide managed protection for waterfowl in a part of the Central or Plains Flyway where suitable areas are badly needed.

One of the important activities this year was the development of newly acquired national wildlife refuges on the Tennessee Reservoir in Kentucky and Tennessee and on Lake Texoma in Texas and Oklahoma. In addition to carrying on development work within the refuges, the Fish and Wildlife Service also gave assistance to the State conservation departments and to the United States Corps of Engineers in the planning and development of waterfowl management areas on these extensive reservoirs. Planting activities, which were an important part of this work, required the collection of enormous supplies of seed on other refuges.

In an effort to afford greater protection to the rapidly declining population of Canada geese, several hundred acres of waterfowl feeding areas were developed along the Mississippi flyway. Steps were taken to increase the usefulness of feeding grounds already available.

The establishment of an additional breeding colony of trumpeter swans was aided by the transfer of 20 cygnets from the Red Rock Lakes Refuge, Mont., to the Malheur Refuge in southeastern Oregon. This increases to 37 the number of young swans now on Malheur. The feeding of the swans during the winter at Red Rock Lakes has continued to hold the breeding population there during the critical season when food and protection are paramount. The present known population of this species—once on the verge of extinction—is 301.

A special effort has been made through cooperative means to increase the refuge acreage planted to grain crops. This not only keeps fields free of weeds, provides goose browse and excellent upland game areas, but also furnishes grain for waterfowl, supplementing the extensive crops of aquatic and marsh plant seeds. The production of cultivated crops on the refuges has also proved to be important in alleviating waterfowl damage to farm crops.

The cultivation of about 30,000 acres of refuge lands by private individuals and refuge personnel in 1945 produced 489,223 bushels of grain and other crops. Other economic uses not inconsistent with proper wildlife management of the refuges were encouraged. A total of 253,490 animal-use months of grazing was permitted on 512,088 acres of grasslands principally after the waterfowl and upland game bird nesting season. In addition, 13,589 tons of hay were harvested on these areas.

The sale of timber products in 1945 was more than double any former year's sale. The removal of selected timber for saw logs, cord wood, and other raw materials is an important wildlife management tool on certain refuges and in addition results in a substantial contribution of materials to aid in the critical lumber shortage.

The total revenue for this fiscal year from all economic uses on the national wildlife refuges, including the disposition of big-game animals, fur animals, and surplus products, was $350,631, which was deposited in the Treasury.

The relaxing of wartime restrictions has been responsible for a marked increase in the use of refuges for recreational purposes. In 1945, 165,798 man-days of recreational fishing resulted in a take of 772,849 fishes. Commercial fishermen removed 894,358 pounds of rough fish.

Improved management practices are responsible for the increased production of fur animals on Federal refuges. At present there are 60 refuges on which fur animals are taken annually, principally on a share cropping basis with the trappers receiving 40 to 50 percent of the annual crop as their payment for trapping. During the fiscal year 1945 the return from the Government's share of furs from wildlife refuges amounted to approximately $140,000.

To maintain the herds of big-game animals on the four fenced big game refuges at a level consistent with the available range, 294 buffaloes, 91 elk, 100 mule deer and 15 white-tailed deer, and 54 Texas longhorns were transferred to State conservation commissions for restocking or were sold or donated for exhibition, propagation, or food. Permits issued to 7 State conservation departments authorized removal of 1,975 deer, 40 elk, 790 fur animals, and 500 ring-necked pheasants for restocking depleted ranges.

Maintenance of buildings and maintenance or replacement of worn-out equipment during the war years has presented a major problem due to shortages of materials and inability to purchase new units. Most of the automotive equipment is 5 to 9 years old and it is becoming increasingly expensive to operate. Replacement of this equipment is expected to cover at least a 5-year period because of the magnitude of the funds required and the slow rate of availability.

On many refuges deterioration of dikes and damage to water-control structures, fences, and trails have resulted from inability to provide the necessary manpower and materials to keep them in proper repair. With the return of former refuge employees who have been in the armed services and with the providing of additional funds it is expected that these areas can be placed in good operating condition.

During the past year engineering developments were undertaken on the Sutter and Colusa Refuges in the Sacramento Valley of California, on the Hagerman and Tishomingo Refuges on the Red River between Texas and Oklahoma, on the Seney Refuge in Michigan, and on the Sabine Refuge in Louisiana. Plans were completed for similar developments on the Horicon and Necedah Refuges in Wisconsin.

TABLE 1.—*Classification and acreage of national wildlife refuges administered by the Fish and Wildlife Service in United States and Territories*

Classification	Number	Acres
For migratory waterfowl	201	3, 213, 658
For other migratory birds and general wildlife	24	3, 870, 156
For colonial nongame birds	49	91, 043
For big game	16	10, 642, 015
Patuxent Research Refuge, Md	1	2, 623
Total	291	17, 819, 495

TABLE 2.—*Acreage acquired or in process of acquisition for national wildlife refuges under the Migratory Bird Conservation Act and by gift, Executive order and public land order*

State	Refuge	Fiscal year 1946				Acquired in previous years
		Under Migratory Bird Conservation Act			Acquired other than by purchase	
		Acquired by purchase	Pending title conveyance	Total		
Arkansas	White River	41		41		106, 345
Delaware	Bombay Hook		4	4		13, 811
Florida	Anclote				18	155
Do	Chassahowitzka		2, 394	2, 394		5, 105
Do	St. Marks	11		11		64, 094
Iowa	Union Slough		205	205		1, 850
Kentucky	Kentucky Woodlands	220	929	1, 149		63, 103
Maryland	Blackwater	2, 558		2, 558		8, 025
Minnesota	Tamarac	240	1, 568	1, 808		29, 906
Missouri	Mingo	1, 432	18, 730	20, 162		2, 468
Nebraska	Crescent	633		633		43, 354
New Jersey	Brigantine		10, 282	10, 282		2, 222
Do	Killcohook		38	38		867
New Mexico	Bitter Lakes	1, 940		1, 940		19, 324
Do	Bosque de Apache		85	85		56, 027
North Carolina	Mattamuskeet		21	21		50, 157
North Dakota	Des Lacs		3	3		14, 021
Do	Lake Ilo		117	117		1, 955
Do	Long Lake	803	1, 593	2, 396		12, 064
Do	Roosevelt				61, 539	
Do	Tewaukon		512	512		80
Oklahoma	Tishomingo				13, 449	
Oregon	Cold Springs		131	131		2, 710
Do	Hart Mountain	5, 076	20	5, 096		225, 762
Do	Malheur	1, 577	30, 316	31, 893		112, 158
Tennessee	Lake Isom	12		12		1, 744
Do	Tennessee				54, 365	
Texas	Hagerman				11, 429	
Do	Laguna Atascosa	11, 275		11, 275		
Do	Santa Ana	113		113		1, 868
Virginia	Chincoteague		143	143		8, 809
Washington	Little Pend Oreille	1, 831	879	2, 710		36, 696
Do	Skagit	1, 982		1, 982		2, 690
Do	Turnbull		1, 006	1, 006		11, 173
Do	Willapa	160	3, 339	3, 499		2, 733
Wisconsin	Horicon	215	3, 159	3, 374		15, 023
Do	Necedah	39		39		39, 362
Total		30, 158	75, 474	105, 632	140, 800	955, 661

Effects of DDT on Wildlife

The need for detailed information on the effects of DDT on wildlife led, in the spring and summer of 1945, to cooperative studies by the Fish and Wildlife Service and the Bureau of Entomology and Plant Quarantine. The latter Bureau initiated the studies and provided funds for the work; the Fish and Wildlife Service furnished most of the personnel. Other cooperating agencies were the National Audubon Society and the Forest Service of the United States Department of Agriculture. The investigations were conducted in the field and in the laboratory and dealt primarily with the control of forest insects and the effects of DDT on forest wildlife.

Excellent cooperation in evaluating effects of DDT on wildlife has also been received during the year from the United States Public Health Service, through the Carter Memorial Laboratory at Savannah, Ga. Special consideration has been given at the Savannah laboratory to measuring the effects on aquatic life of the use of DDT as a larvicide for control of malaria-carrying mosquitoes. Attention is also being given to effects of repeated applications of DDT on terrestrial animals.

The principal field investigations by the Fish and Wildlife Service to evaluate effects of DDT used as a spray for control of forest insect pests were made in Maryland and Pennsylvania, but observations were also made at localities in other States and in the Province of Ontario.

At the Patuxent Research Refuge in Maryland, population studies in preceding years had laid a sound base for the evaluation of changes in 1945. In Lackawanna County, Pa., the current year's nesting population of birds was determined before DDT was applied. Elsewhere studies were confined to the making of observations from shortly before until shortly after the application of DDT.

Most of the DDT was sprayed by airplane at rates varying between one-fifth and five pounds of DDT, in an oil solution, per acre. However, one pound per acre has been found enough to control many forest insect pests. A single application was the basis for each study. The amount of DDT that reached the vegetation was found to vary considerably, due to difficulty of application and varying density of vegetation.

The results of the investigations indicated that where applications of DDT were at the rate of 2 pounds or less per acre there was no measurable damage to mammals, birds, or amphibians. At five pounds per acre, however, birds and amphibians were killed in considerable numbers and there was evidence that a nesting population of birds was much reduced, probably through reduction in the supply of insect food. In general, invertebrates, fishes, and other cold-blooded vertebrates were more seriously affected than were birds and mammals.

The studies indicated strongly that DDT should be used for the control of insect pests only after weighing the value of such control against the harm likely to be inflicted on beneficial forms. Where used, minimum doses should be applied.

A circular on DDT entitled, "DDT: Its Effect on Fish and Wildlife," was issued during the year.

Nutritional Deficiency in Bobwhite Quail

In wildlife, as in man, nutritional deficiencies often spell the difference between life and death. Studies have been conducted at the Patuxent Research Refuge as a means of exploring and determining the possible importance of nutritional deficiencies in survival of wildlife populations. Several very significant discoveries have been made.

Studies on the vitamin A requirements of the bobwhite quail have established the optimum level of this factor for breeding quail, for growing stocks, and for maintenance in winter. A lack of vitamin A was found to be rapidly fatal both to chicks and adults, while a deficiency of vitamin A in the diet of the breeders affected not only their own survival, and their productivity, but also survival of their offspring. A deficiency in the growth diet affected the growth rate and survival of chicks and their viability during winter; a deficiency in the winter-maintenance diet affected winter survival and subsequent productivity.

This research suggests that not only may a deficiency of vitamin A be responsible for the failure of many restocking programs which utilize pen-reared quail, but also it may be a potent factor in the periodic fluctuation in the population of wild quail and the shrinkage of their natural range.

Two experiments with 944 quail chicks revealed an abnormal feathering caused primarily by a deficiency of riboflavin (vitamin G). A twisted condition occurred in both primary and secondary feathers of the wings, with a corresponding stunting of the tail and body feathers. The incidence was greatest on a diet containing no milk by-products, which are good sources of riboflavin, and diminished as the percentage of milk by-products in the diet was increased. Feathers twisted as severely as were some by these experiments would handicap liberated birds badly in flight and so make them more vulnerable to predation.

Water Utilization and Wildlife

The nationwide movement to develop our rivers in the interest of flood control, irrigation, navigation, and hydroelectric power will radically change the character of our streams and surrounding lands and have a far-reaching effect on fish and wildlife. It is the responsibility of the Fish and

Wildlife Service to protect and enhance fish and wildlife resources; the Service therefore participates in water utilization programs to provide technical analysis and advice in such projects insofar as the provision of tolerable conditions for wildlife is concerned.

Realizing that planning for the fish and wildlife resource must coincide with planning for other purposes, the Service has established a field staff of biologists and hydraulic engineers. These specialists review engineering plans for river development by the Bureau of Reclamation and the United States Corps of Engineers, study the areas involved, evaluate the resources affected by the project, and suggest modifications necessary to mitigate losses and to derive maximum benefits for fish and wildlife. These studies give special consideration to the maintenance of proper water levels in reservoirs and of flows in streams below dams; to preserving adequate spawning, nursery and rearing areas for fish; to correcting pollution; to biological rehabilitation and development of areas for wildlife; and to practical means of protecting fish and wildlife from the hazards of such construction. Reports on projects are submitted by the Service to the Bureau of Reclamation and to the Corps of Engineers for incorporation in their over-all reports.

Many of the contemplated projects will occupy the habitat of some of our most important fish and wildlife species. The river bottomlands, generally speaking, are the areas most prolific of wildlife. For example, migratory waterfowl and numerous species of upland game use the bottomlands especially in the winter season. It is conceivable that a series of reservoirs in a valley could destroy the entire supply of winter cover on which deer and certain game birds depend, and thus eliminate the animals themselves.

Certain projects proposed in the comprehensive plan for the development of the Missouri River Basin will have a major effect on important waterfowl nesting refuges in Montana and the Dakotas. The replacement of nesting habitat eliminated is mandatory for the fulfillment of international treaties and protection of the Federal and State investment.

Our aim is to develop the best methods to utilize the facilities that are being created. Reservoirs are viewed from the standpoint of their future use for the production of sport and commercial fish, as State or Federal migratory waterfowl refuges, and as public shooting grounds. For the highest usefulness of the impoundments in the interest of conservation, the Service is attempting to devise means of increasing fish and wildlife habitat through reasonable and practical modification in the structure and operation of reservoirs. By such modifications, a project may be changed from the debit to the credit side of the evaluation ledger, from the fish and wildlife standpoint.

It is not enough to insure maximum production of fish and game by incorporating sound biological considerations in the development plans; these resources must be managed subsequent to construction and impoundment. Only this combination—suitable habitat and good husbandry—will produce and sustain fish and game crops on the land and water types to be created by the national river development program.

Federal Aid to State Projects for the Restoration of Wildlife

The Pittman-Robertson Federal aid to wildlife restoration program has given invaluable aid to the States in their efforts to meet the increasing demands on wildlife resources. Funds for this cooperative restoration work are derived from an excise tax imposed on firearms, shells, and cartridges. The money thus collected is set aside in a special account, known as the "Federal aid to wildlife restoration fund." Each year Congress authorizes the expenditure of a certain portion of this fund, the Federal apportionment being then supplemented by the States, which contributes 25 percent of the cost of each project. All of the States except Nevada, which has not passed required legislation, are eligible to participate in this program. All proposed restoration projects are examined by the Fish and Wildlife Service, which determines whether they are sound in purpose and design before giving the requisite Federal approval.

Sales of hunting licenses during the fiscal year 1945, as compared with the previous year, increased by 9.3 percent. Complete figures for the fiscal year 1946 are not yet available; however, all indications point to a continuation, and indeed an acceleration, of the upward trend. The resulting increase in hunting pressure upon all game resources makes more than ever necessary an intensive restoration and management program.

TABLE 3.—*Status of Federal aid to wildlife restoration fund*

Fiscal year	Amount collected	Amount appropriated
1939	$2, 976, 020	$1, 000, 000
1940	3, 707, 844	1, 500, 000
1941	5, 535, 773	2, 500, 000
1942	5, 072, 588	2, 750, 000
1943	1, 149, 333	1, 250, 000
1944	1, 061, 045	1, 000, 000
1945	3, 132, 402	900, 000
1946	[1] 3, 283, 523	1, 000, 000
Total	25, 918, 528	11, 900, 000

[1] Amount collected from July 1, 1945, to April 30, 1946, inclusive.

Projects obligating $1,191,795.47 were approved during the year. This sum, which is more than the amount appropriated and apportioned for the fiscal year, was available in part from the appropriation for the previous year, and from unexpended balances of completed projects. Projects approved during the year consisted of 73 research projects, obligating $49 491.57; 55 development projects, obligating $333,844.96; 48 land projec obligating $262,573.43; and 16 coordination projects, obligating $10 885.51; or a total of 192 projects obligating $1,191,795.47.

The amount of $1,000,000 was appropriated for Federal aid in wi life restoration for the fiscal year ending June 30, 1946. This was an i crease of $100,000 over the appropriation for the previous year. Th appropriation was apportioned as follows:

Alabama	$12, 022. 31
Arizona	18, 549. 45
Arkansas	11, 195. 68
California	39, 413. 47
Colorado	27, 381. 56
Connecticut	5, 000. 00
Delaware	5, 000. 00
Florida	11, 435. 08
Georgia	10, 806. 14
Idaho	19, 060. 46
Illinois	23, 819. 32
Indiana	25, 209. 97
Iowa	19, 219. 25
Kansas	16, 904. 67
Kentucky	9, 991. 78
Louisiana	12, 946. 09
Maine	11, 443. 02
Maryland	5, 667. 48
Massachusetts	6, 064. 46
Michigan	51, 201. 58
Minnesota	31, 556. 68
Mississippi	10, 473. 29
Missouri	21, 812. 29
Montana	27, 495. 90
Nebraska	18, 261. 25
Nevada	*16, 915. 50
New Hampshire	5, 132. 82
New Jersey	8, 075. 15
New Mexico	19, 428. 29
New York	$41, 621.
North Carolina	13, 015.
North Dakota	13, 010.
Ohio	34, 611.
Oklahoma	15, 040.
Oregon	21, 374.
Pennsylvania	40, 653.
Rhode Island	696.
South Carolina	7, 457.
South Dakota	16, 570.
Tennessee	13, 143.
Texas	45, 430.
Utah	17, 255.
Vermont	4, 002.
Virginia	13, 260.
Washington	26, 114.
West Virginia	13, 453.
Wisconsin	25, 154.
Wyoming	16, 739.
Apportioned to States	880, 000.
Alaska	12, 000.
Hawaii	5, 000.
Puerto Rico	3, 000.
Deducted for administration	100, 000.
Appropriation	1, 000, 000.

* Set aside pending adoption of qualifying legislation.

The Patuxent Refuge—a Laboratory for Conservation

Programs of investigation in progress at the Patuxent Wildlife Researc Refuge in Maryland—of which a large part of the DDT studies and th nutritional work on game birds are examples—have caused this statio to become a mecca for visiting scientists from many States and from othe parts of the world. Many agencies engaged in conservation work or i activities related to conservation have sent their representatives to con sult on special problems and, in some instances, to spend a limited perio of time studying procedures and results. Obtaining first hand informatio on DDT tests or in the use of 1080 has been of major interest to many, bu numerous others have come to consult the extensive files at the refuge, t perform specialized phases of wildlife research, or to spend a period o apprenticeship in wildlife work. In particular many States and college ave sent young men to the refuge to obtain the benefits of its expert techcal guidance, extensive reference collections and other laboratory facilies in analyzing the food habits of wildlife.

Cooperative Wildlife Management Studies

Ten cooperative wildlife research units, financed by State conservation ommissions, the land-grant colleges, the American Wildlife Institute and he Fish and Wildlife Service, revived their wildlife research and training rograms immediately on the cessation of hostilities. Graduate fellowships were restored and at the end of the fiscal year the units were operating at ull capacity.

Alabama.—Projects included studies on bobwhite quail, fox predation, mourning doves, wild turkeys, and white-tailed deer. Publications were ummer Food of Bobwhite Quail and Bobwhites November Menu. An xtension project on wildlife conservation and utilization reached 12,000 andowners.

Pennsylvania.—Management studies were made on ruffed grouse in wo central Pennsylvania forest types. Increasing wildlife food production by selected tree fertilization in hardwood forests, fall and spring populaion studies of woodcocks, propagation and nutrition of game birds, improvements in venison cookery, and studies in wild bird homing migration were important activities during the year.

Ohio.—Research projects at this station included work on ring-neck pheasants, cottontail rabbits, pheasant repellents, farm ponds, and determining effectiveness of game management practices on strip mine areas. The chief publication during the year was the cooperatively authored book The Ring-necked Pheasant and Its Management in North America in which the major contribution was from the Ohio unit.

Texas.—The most important work done in Texas was on problems of deer and wild turkey management. Other projects included an ecological survey of Big Bend National Park, range use and ecology of the prong-horned antelope and wildlife food production in coastal southeastern Texas.

Iowa.—Important projects continued in Iowa were a study of muskrat populations as affected by quail disease, management in a State land acquisition program, waterfowl and pheasant management studies, experiments in game cookery and white bass investigations on Spirit Lake. Investigations of Iowa foxes were resumed with emphasis transferred to the gray fox.

Maine.—As a result of low muskrat populations for several years, emphasis was given to investigations of that species. Other pre-war projects revived during the year included deer management, and investigations on ruffed grouse, waterfowl and woodcock. The woodcock population studies were greatly expanded through cooperation of other workers; intensiv studies on the black duck and ring-necked duck were initiated.

Oregon.—A 400-page manuscript on the prong-horned antelope has bee completed for publication in book form. Projects studied during the yea include game management on farm lands, management of blacktail dee big-game range studies in arid ranges, and ring-necked pheasant management in eastern Oregon. A bulletin on preparation of wild game for foo was published.

Utah.—Research projects for the year were biological studies on mul deer, antelope, waterfowl, muskrats on Ogden Bay Refuge, native rabbits and upland birds, and analysis of annual game kill and fur take.

Missouri.—During the year a comprehensive report on the wild turke studies was completed for publication, a long-range deer-livestock investigation was initiated in cooperation with the United States Forest Service and a far-reaching study of wildlife in relation to modern agricultura practices was initiated with the cooperation of several agencies and, notably a manufacturer of ammunition.

Virginia.—A book on the mammals of Virginia was completed for publication, substantial progress was made on a comprehensive report o Virginia big game, and a State-wide study of farm ponds was initiated.

Wildlife Research on Public Lands

A slight expansion of wildlife investigations on public lands was mad during the latter part of the fiscal year through return of four biologist from military furlough to their positions in the States of Washington, California, Minnesota, and Maryland. Nevertheless, inadequate funds an manpower have not made it possible to meet the numerous requests fo assistance that are continually received from the various land-managemen agencies.

The integration of game and forest management, and the relation o rodents to forage production are the two major wildlife problems in the national forests. The maximum combined game-timber productivity o forests can be realized only when the environmental requirements of game are learned and applied and when game officials and sportsmen fully appreciate the necessity and means of keeping game populations well within the carrying capacities of their forested ranges. A survey of national forests in the Southern States indicates that game-carrying capacities there can be increased somewhat by adoption of certain forest management practices not detrimental to timber production.

The relation of rodents to forage and timber production is under investigation in various areas, but since all these investigations deal chiefly with the effect of animal life on plant succession and growth, many years of work are required before conclusive evidence can be obtained.

A wide variety of investigations were made on national park lands, and sistance was given to Indian tribes in the management of their resources muskrat, beaver, and fish.

In Oregon, an important study was continued on State and private forest nds to learn methods of controlling mice (*Peromyscus*) on areas where eforestation of Douglas fir by direct seeding was in progress. Although he work is not yet complete, the data accumulated so far give great promise hat a practicable and economical means of aiding direct seeding of Douglas r will be developed. The work has great significance throughout the ouglas fir region of the Pacific Northwest, where vast acreages of burned or lear cut land can be economically reforested only if the direct seeding ethod is perfected.

Fur Farming and Rabbitt Raising

The Fish and Wildlife Service has taken an active part in the restoration of fur farming during the period of readjustment. This activity is an important part of our agricultural development and fits in well with conventional farming.

The most serious effect of the war on fur animal research has been the loss of trained personnel at the various experimental stations and laboratories where such work was carried on. In spite of this handicap, however, the Fur Animal Experiment Station at Saratoga Springs, N. Y.; the Fur Animal Field Station, Cambridge, Md.; the Rabbit Experiment Station, Fontana, Calif.; and other stations where cooperative work is in progress have all made valuable research contributions to fur farmers, rabbit raisers, and fur tradesmen.

On April 30, 1946, the President approved a bill (H. R. 2115) which transferred all functions of the Secretary of the Interior which affect the breeding, raising, producing, marketing, or any other phase of the production or distribution of domestically raised fur-bearing animals or products thereof, to the Secretary of Agriculture, effective July 1, 1946.

Cooperative Control of Predators and Rodents

Active control operations against injurious rodents and predatory animals carried out by the Federal Government in cooperation with States, local governments, and individuals during the year entailed expenditures of $914,600 from regular departmental appropriations, supplemented by $935,401 from cooperating States, and $1,562,471 from cooperating counties, livestock associations, and others. Predatory animals taken during the year under this cooperative program amounted to 117,204, exceeding last year's records by 4,753, and consisted of 108,311 coyotes, 1,557 wolves, 6,487 bobcats and lynxes, 730 bears, and 119 mountain lions. In rodent control operations 11,397,769 acres of infested lands were treated for the control of prairie dogs, ground squirrels, pocket gophers, jack rabbits, fiel mice, cotton rats, kangaroo rats, porcupines and woodchucks. In add tion, 442,004 premises were treated in cooperative campaigns for the con trol of common brown and other house rats. Equipment and supplies use in predator and rodent control, and 639,995 pounds of rodent bait materia were distributed to cooperators throughout the country by the suppl depot at Pocatello, Idaho.

It is the established policy of the Fish and Wildlife Service to conduc predatory animal control projects for the protection of livestock, poultry, an game in areas where the need is most pressing. The coyote is the chief subject of control because it is responsible for a greater total loss to livestock an poultry than all other predators combined. The world shortage of foo which prevailed during the past year emphasized the importance of thi cooperative predator and rodent control work. Protection of livestock from destruction by wild predators has provided greater quantities of beef, lamb pork, and poultry to alleviate world-wide shortages; and the control o rodents has increased the available supply of other food products by reducing damage to crops and destruction of stored food.

The Service continued to render direct aid in conducting rat contro work on military and naval installations for the protection of food store and other strategic supplies.

The practice of encouraging State and local participation in predator an rodent control through cooperative grants of Federal assistance and supervision was continued this year, with the same excellent results that have characterized the work since its initiation 30 years ago. As of June 30, 1946 cooperative agreements were in effect with 29 States and a large number o counties, cities, livestock and farm associations, and individuals. Such agreements were in effect in many eastern States and all States from the Great Plains westward, excepting Kansas, South Dakota, and Utah.

Protection of Livestock and Game

The cooperative control of wild animals that prey upon domestic livestock and game species continued to fall far short of demands for such work, due to insufficient appropriations and personnel. The continuation of low prices for long-haired furs, like coyote, wolf, and fox, resulted in a dearth of private trappers and very little aid from that source. Many hunters supervised by the Service on cooperative control programs have worked with increased diligence in an effort to make up for such impediments.

Increased and improved use of the coyote-getter (a small, set gun containing cyanide) in Texas has been the chief factor in achieving a 45 percent increase in the number of coyotes and wolves taken. Over 35 percent of the total Service and cooperative take of 24,842 wolves and coyotes in Texas during this fiscal year was accounted for by using coyote-getters.

he advantages of this device are its simplicity, requiring a minimum of ained hunters; its adaptability to use on ranges grazed by livestock or ame; and its humane effectiveness against coyotes or wolves, especially ose that are trapwise. Other States have reported equal or greater success ith the coyote-getter.

rotection of Crops and Stored Foods

It is estimated that there may be 130 million rats in the United States, nd that the annual loss from food destroyed or damaged by rats and mice mounts to at least $200,000,000.

The control of rodents destructive to growing crops and stored or rocessed grains and other food has been more seriously affected by war-me conditions and subsequent slowness of reconversion than has the ontrol of predators. This is because rodent control requires a propor-ionately greater amount of manpower, which has been a critical factor hroughout the year. The situation has been somewhat relieved by the act that red squill is again being imported and by the greater availability f other poisons. Still greater aid has come from development of tech-iques which permit more widespread use of powerful new rodenticides, specially sodium fluoroacetate (compound 1080).

It is fortunate that during the present period of inadequate personnel he population of field rodents has been, in general, at a relatively low ebb hroughout the country. This has enabled the Service and its cooperators o devote a larger part of the available men and money to the pressing roblem of controlling house rats and mice on farms and in cities where food is stored or processed. The magnitude of this job, however, makes t far beyond solution with the limited resources now avialable.

The huge loss chargeable to rats and mice may be more easily comprehended when expressed in terms of actual individual losses. For example, a wholesale grocery building in Sulphur Springs, Tex., yielded 60 dead rats when treated with compound 1080. Rats had previously destroyed quantities of feed stored in this wholesale house, making it necessary to discard some 4,200 pounds at one time. The owners reported that approximately 5,000 pounds of grain had also been spilled through the floor cracks from sacks cut open by rats.

A wholesale grocery at Lawrenceville, Ga., which was an active backer of the city rat control campaign conducted there, reported recent losses of $800 worth of flour through cutting and contamination by rats. The monthly losses of various types of produce amounted to approximately $125 per month.

In controlling rats that are causing damage such as described, the Fish and Wildlife Service has taken the lead by developing compound 1080, and working out methods for the safe use of this highly toxic substance.

The material is too dangerous for use by the general public, but when use by properly trained persons in accordance with recommendations it produces results that are spectacular. Use of this poison at the city dum of Sidney, Mont., yielded 1,110 dead rats the day after the poisoning, 20 on the second day, and 5 the third day. During additional checks no mor rats, dead or living, were found. Similar results have been obtaine at other city dumps in other States.

One of the most spectacular kills of rats made with 1080 in a wate solution was at a New Orleans grain and elevator building known to b heavily infested with rats. The poison was exposed on all floors of th building along rat runs in small cups which held about one-half ounce o the solution. Within the first 24 hours, 3,690 dead rats were picked up Additional dead rats were found the next 2 days.

Compound 1080 has also proved effective against infestations of fiel rodents which it is difficult or costly to eliminate by other methods. Numerous spot infestations of prairie dogs, particularly in Texas, Arizona Utah, Colorado, and New Mexico, have been cleaned up by using this new poison in grain bait that is dyed a brilliant yellow to discourage birds from eating it. Rodents, being color blind, eat the dyed grain without hesitation There was no apparent effect upon bird life in the areas treated. This method of preventing damage to birds, recently developed in the Denve Wildlife Research Laboratory of the Service, is now being used to an increasing degree in rodent-poisoning operations.

Field mice are reported on the increase in the Atlantic States and in central Utah, doing extensive damage to orchards and garden crops. Compound 1080 has proved effective against these rodents. Rice and cotton rats have continued to require control in the Southern States, chiefly in South Carolina and Florida, on both truck farms and sugarcane fields. Because of manpower difficulties, control of porcupines has been possible in only a few areas.

The need for ground squirrel control has been slight, populations of these animals now being at a low point in the cycle of abundance over much of their range.

Accompanying the generally low cycle of rodent populations, there is a noticeable scarcity of jack rabbits throughout nearly all of their range. In North Carolina and Nebraska the Service assisted orchardists and others by using a recently developed rabbit repellent known as 96–A. Results have been good there as well as in the northern plains, where the repellent has proved beneficial on shelter belt and orchard trees.

Conservation of Inland Fishery Resources

On the whole, the inland game fisheries of the United States were not adversely affected by the war. To a great extent the moderate drain on fresh-water fisheries was linked with the rationing of gasoline and tires, which prevented anglers from traveling any great distance to fish. Waters near metropolitan areas were heavily fished and in some sections the stock of fish was reduced to a certain extent. In other waters where the fishing pressure was less the stock was rebuilt somewhat. On the other hand, limited manpower and other facilities made it impossible to carry on a large scale program for the development of the inland fisheries.

Artificial Propagation

Despite wartime difficulties—insufficient operating personnel, shortages of proper fish foods for trout and salmon and of pond fertilizers for warm water fish—the fish-cultural program as a whole held up very well. Production of several species dropped slightly, but some of the important forms, like chinook and silver salmons, and brook and brown trouts, showed an increase.

During the calendar year 1945, Service hatcheries produced a total of 5.5 billion fish and eggs (table 4).

TABLE 4.—*Summary, by groups, of the output of fishes and eggs during the calendar year ended Dec. 31, 1945*

Group	Eggs	Fry	Fingerlings or larger	Total
Catfishes			681, 445	681, 445
Blue catfish			150	150
Channel catfish		110, 000	137, 355	247, 355
Buffalofish	75, 000, 000		102, 000	75, 102, 000
Shad		21, 370, 000		21, 370, 000
Whitefish		700, 000		700, 000
Lake herring		2, 250, 000		2, 250, 000
Striped bass		279, 000		279, 000
Atlantic salmon			90, 835	90, 835
Chinook salmon	4, 528, 480	10, 507, 140	27, 533, 380	42, 569, 000
Chum salmon		2, 452, 200	80, 000	2, 532, 200
Silver salmon	88, 420	915, 600	1, 600, 110	2, 604, 130
Sockeye salmon	354, 670		1, 662, 395	2, 017, 065
Landlocked sockeye salmon	156, 690		85, 650	242, 340
Landlocked salmon			61, 770	61, 770
Steelhead trout	180, 740		207, 625	388, 365
Rainbow trout	11, 117, 950	643, 380	8, 890, 995	20, 652, 325
Cut-throat trout	14, 761, 840	3, 660, 870	2, 827, 450	21, 250, 160
Loch Leven or brown trout	1, 296, 660	74, 100	2, 476, 660	3, 847, 420
Lake trout	5, 000	179, 600	1, 155, 615	1, 340, 215
Brook trout	14, 020, 800	410, 670	5, 389, 770	19, 821, 240
Grayling	1, 709, 740		3, 450	1, 713, 190
Northern pike	14, 110, 000	920, 000	2, 160	15, 032, 160
Crappie			1, 106, 330	1, 106, 330
Largemouth black bass		428, 620	5, 727, 560	9, 156, 180
Smallmouth black bass		894, 000	159, 805	1, 053, 905
Rock bass			54, 610	54, 610
Warmouth bass			5, 140	5, 140
Bluegill sunfish		153, 000	12, 400, 760	12, 553, 760
Red-eared sunfish			1, 638, 070	1, 638, 070
Rio Grande perch			30	30
Pike-perch	300, 000	29, 425, 000	275, 500	30, 000, 500
Yellow perch	308, 000	1, 540, 000	56, 050	1, 904, 050
White perch		1, 035, 000		1, 035, 000
White bass			480	480
Cod	1, 981, 366, 800	206, 615, 600		2, 187, 982, 400
Haddock	153, 000, 000			153, 000, 000
Flounder		1, 721, 295, 400		1, 721, 295, 400
Pollock	904, 051, 200	191, 826, 900		1, 095, 878, 100
Lobster		2, 986, 000	103, 435	3, 089, 435
Terrapin	130		12, 000	12, 130
Grand total	3, 176, 357, 120	2, 203, 672, 180	74, 528, 585	5, 454, 557, 885

To meet the needs of modern conditions, the trout-propagation program in Federal hatcheries is undergoing some modification. Under intensive hook and line fishing, which is extending more and more to the isolated areas, it has been found that neither natural reproduction nor the planting of small fish is adequate to maintain the stock and support good fishing. Legal-sized trout are needed to maintain the stock in heavily fished areas. The most economical time to plant these fish is in the spring and during the open fishing season. Although most of the trout-cultural programs over the country are now pointed toward a policy of this kind, hatcheries as a rule are ill fitted to support this modern program, having been designed for the production of fry or fingerling stages. Propagating trout to legal size requires large quantities of fresh meat and other foods, more space, and a better trained and larger staff to cope with problems attendant upon the longer growing period for the fish and their confinement to limited hatchery space.

During the early part of the war the Service undertook to insure good fishing for men located in Army camps and rehabilitation centers by stocking suitable waters on or adjacent to Army, Navy, and Veterans' Administration areas. In a number of instances this program was carried on cooperatively with State conservation departments. During the year approximately one-half million fish, many of legal-size, were provided for stocking these waters. A number of the wounded men fished from wheel chairs when they were able to do little else. This recreation was conducted as a part of reconditioning training, and according to the reports of officers in charge, recovery and return to normal status was materially hastened for hundreds of men by this outdoor sport.

During the year research directed toward the improvement of fish-cultural techniques and practices was actively prosecuted. Activities along this line included: biological control over production at the fish-cultural stations associated with the Grand Coulee and Shasta Dams; nutritional and pathological investigations pertaining to salmon and trout culture; and general studies of certain proposed water development projects in the Columbia Basin to determine how artificial propagation can be most effectively employed, where indicated, to mitigate adverse effects of the projects upon the food-and-game-fish resources.

Several devices and procedures developed during the year have increased the efficiency of fish culture. For example, two types of mechanical "feeders" were developed for feeding fingerling fish in large rearing ponds with less wastage of food and with a reduction of approximately 80 percent in the labor involved; practical methods were developed for enumerating salmon eggs and fingerlings, assuring greater accuracy with no additional effort; several new disinfectants were tested and show great promise for controlling diseases among hatchery fish; and a program of nutritional re-earch leading to the development of cheaper, nutritionally adequate diets or salmon fingerlings, was initiated.

During the year the study of the effects of various chemicals on *Bacterium almonicida,* causative organism in the trout disease, furunculosis, has been n important activity. Of the several drugs tried, sulfamerazine proved he most effective.

Because of the extensively developed use of liver in human nutrition he quantity available for fish-hatchery use has become extremely limited, and the price prohibitive. The Service is making fundamental studies of fish nutrition to find suitable low-cost substitutes and to determine the exact nutritional requirements of fish. As an example, the nutrition laboratory of the Service maintained at Cortland, N. Y., in cooperation with Cornell University has just completed a report on the utilization of carbohydrates by fish.

Farm Ponds

During recent years the economic value of farm ponds has been thoroughly proved. It has been found that these small ponds, usually 1 to 5 acres in area, will produce 200 to 300 pounds of edible fish per acre annually, especially in the South, if they are properly fertilized and fished.

The stocking of multiple purpose farm ponds with fish from Federal hatcheries reached a new peak during the calendar year 1945. During this period 7.6 million fish were furnished to stock farm ponds, an increase over 1944 of more than 90 percent. Farm ponds created under the auspices of the Soil Conservation Service received 4.9 million fish. Many of the remaining fish were planted in ponds sponsored by the Agricultural Extension Service and the Agricultural Adjustment Agency. In connection with the stocking of farm ponds, the Fish and Wildlife Service made 13,276 individual plantings during the year. These represented only a portion of the total ponds stocked since many areas were planted with fish from State hatcheries. Most of the fish planted in farm ponds were warm-water species, with large-mouth black bass and bluegill sunfish the most popular forms.

Hatcheries which are supplying fish for farm pond applications have now reached almost their maximum production. Some slight increases might be effected by better management of the ponds, additional use of fertilizers, and careful planning of the disposition of the product. The relation of farm ponds to soil-conservation activities and to the conservation of wildlife has been well established. As soon as equipment becomes available, additional contractors are expected to enter the field of pond construction, and demands for fish will be materially greater than at present. These anticipated demands can be met only by additional personnel and by modernization of existing stations and the construction of new units i selected localities.

Dams Versus Fish Populations

The development of rivers for power, irrigation, and navigation pose endless problems in fishery conservation. To preserve even the minimum life requirements of fish populations in streams undergoing vast modern engineering developments demands long study and careful planning b biologists and engineers. But such planning is only the initial step which must be followed by continuous management of the fisheries affected i the value of these resources is to be preserved for the public. Details o the management program will vary from one situation to another, bu may require major salvage operations, as on the Columbia River, and will usually embrace a program of artificial propagation.

The year brought fresh confirmation of the success of the most ambitiou management program of this type ever undertaken—the transfer of all the salmon runs blocked by Grand Coulee Dam to new spawning tributarie downstream from the dam.

For the second consecutive year since the relocation activities were terminated, the fish were allowed to pass upstream unhindered. Only a few strays proceeded upstream to Grand Coulee Dam, the vast majority turning off and entering the tributaries to which the runs had been relocated. Notwithstanding some inevitable losses as a result of relocation there appears no question that the major portion of the fish have been successfully transplanted to the tributaries below Grand Coulee Dam On the Sacramento River, where a similar problem exists, the salvage program was continued, and observations indicate that the plan of providing for spawning in the main river has been successful. Such spawning has been made possible chiefly through the withdrawal of cool water from the lower levels of the reservoir.

Fundamental research is being carried on in several river systems on problems that occur widely. An example of such generally applicable research is the determination of the mortality of the downstream fingerlings when passing large main-stem dams. This is being studied at Bonneville Dam, where fingerling traps and fyke nets are being operated to determine the seasonal, horizontal, and vertical distribution of the downstream migrants. Methods of diverting the migrants away from actually or potentially dangerous passages and into safe channels of migration are being sought. Since every dam creates an impoundment and for that reason markedly changes the environmental conditions in the stream area, an intensive study of the effect of impoundments, insofar as fish life is concerned, has been inaugurated. Biological and physical data are being obtained t a number of reservoirs in order to make possible an estimate of the probble effect on the fish life that will result from the construction of any of the roposed dams.

Virtually all of the tributaries of the Columbia River used by anadomous fish for spawning and rearing areas have been surveyed in preious years; others were studied during the past year. The tributaries in he lower reaches of the Columbia River have particular importance, since his area must assume the burden of maintaining production for the entire iver as the construction of additional main-stem dams destroys the upper iver runs.

An experimental relocation of upper Columbia River spring chinook and lueback salmon to a hatchery in the lower river has been attempted. If uccessful, the progeny will be studied over succeeding generations to determine the effect, if any, of the greatly reduced distance covered in the pawning migration upon the physiological characteristics of these runs.

Pollution and the Fisheries

Water pollution in the United States causes tremendous losses of natural resources. The Fish and Wildlife Service is concerned with the problem as it affects fish life in lakes and streams, fish and shellfish in coastal waters, fisheries in the offshore waters, and wildlife.

A major effort has been made during the past year to determine the pollution hazards to fish and other aquatic organisms created by new effluents and by various new chemicals developed during the war for use as insecticides and plant-killing agents. These studies have been directed not only toward the determination of the critical and immediately lethal effects of the substances, but also to the determination of the action of these materials and effluents, when in high dilution, on the various components of water favorable to fish life and on the fish themselves. Numerous cases of specific pollution have been surveyed and evaluated in response to particular requests, and new methods for the study of water quality problems and stream pollution have been developed.

Conservation of Marine Fishery Resources

More than 95 percent of the total quantity of fish and other aquatic products landed by our fishermen is derived from the oceans surrounding the coasts of the United States and Alaska. The study of these great sea fisheries is therefore one of the most important and necessary activities of the biologists of the Fish and Wildlife Service. Although the Federal Government has actual power to regulate the fisheries only in Alaska, its recommendations, based on the findings of its biologists, are freely made available to the State conservation agencies to guide them in the protection and development of these resources.

Between 1941 and 1945, many long term biological studies were unavoidably interrupted or greatly reduced in scope through the contingencies of war. The past year has been a period of reconversion, many of the fishery biologists being still largely occupied with wartime assignments, and with reviewing and resuming biological research projects. Considering the difficulty of restoring depleted personnel and obtaining funds for resumption of full-time biological research, the progress made by the end of the year can be considered encouraging.

North Atlantic Fisheries

Studies in the North Atlantic area were concentrated on the fisheries for haddock, lobster, flounders, rosefish, and Atlantic salmon.

The decline in the productivity of the haddock fishery on Georges Bank, center of the present fishery, has been linked to the failure of the years 1941 through 1943 to make important additions to the population through spawning. This failure to maintain the population has been revealed by an analysis of the changing size and age composition of the catch. Study of the distribution of haddock on the fishing grounds and of the total production of all species of groundfish provides a hint of the underlying cause of these spawning failures: Competition for food, coupled with an actual decline in the food-producing capacity of the bottom. Whether any season since 1943 has provided a large brood of haddock to relieve the situation is not yet known, several years being required for the young fish to reach commercial size.

The catch of yellowtail flounders, now one of the most important of the North Atlantic fishes, declined so sharply in 1945 that the catch-per-day was less than one half that made three years earlier. Biological studies indicate that this decline in the catch is linked with an actual decrease in the stocks of this species.

In Maine, center of the lobster fishery, the catch of this valuable crustacean rose from about 7½ million pounds in 1940 to nearly 18 million pounds in 1945, following a long period of low productivity by this resource. The Service has conducted an investigation designed to evaluate the causes of this increase in the catch. Rearing and stocking operations apparently could account for less than 1 percent of the increase, while the increase in the size limit in 1942 could account for not more than 10 to 20 percent. Preliminary conclusions indicate that the balance of the increase resulted from favorable levels of spawning and competing stocks. Studies of these factors, however, are only partially completed.

Salmon restoration studies were continued, including experiments to determine the best season and age to stock hatchery-reared young, experimental stocking of Pacific silver salmon, and limited Atlantic salmon estoration experiments. A preliminary survey of Connecticut River dams, power developments and tributaries, was made in connection with fishway recommendations, and experiments were started on fishways and on a new type of fish weir for holding small salmon.

Studies of the rosefish, which for several years has supported New England's largest fishery, show that the average daily catch per boat on the New England banks is declining in spite of improved fishing methods, and that the average size of the fish is decreasing. Both changes signify a decrease in the stocks. As further warning that this species requires careful management, preliminary analysis of the age and growth rates from scales and length measurements indicates that it is very slow growing. Growth of immature fish may be less than one inch a year, and maturity may not be reached until 10 to 12 years of age.

Middle Atlantic Fisheries

Fishery research in the Middle Atlantic States was confined to (1) the shad: continued observations to determine whether the shad fishery is remaining at its recent high level of abundance in the Hudson River: determination of causes of decline in other rivers, and the formulation of practical methods for the rehabilitation of the fishery in the Delaware region; analysis of the effectiveness of a recently introduced management plan for the Chesapeake Bay; (2) blue crab: study of the fishery of Chesapeake Bay to determine the causes of sharp fluctuations in production (analyses to date indicate that they result more from natural environmental conditions than from the effects of fishing intensity); and (3) shore fishes like sea bass, summer flounder, and striped bass which comprise an important segment of the fishery by commercial and sports fishermen in the Middle Atlantic area.

Great Lakes Fisheries

Reports were completed during the past year on the whitefish fishery of Lakes Huron and Michigan, on the 1942–43 mortality of smelt in Lakes Huron and Michigan, and on the distribution, spawning, age and growth of the kiyi (one of the "whitefish chubs") in Lake Michigan.

Work has been continued or initiated on the distribution and growth of the longjaw (another "whitefish chub") in Lake Michigan; the relationship between soil erosion as a source of turbidity and silt deposits and the abundance of Great Lakes fish, especially in Lake Erie; the yellow pike fishery and the growth and artificial propagation of the yellow pike in Saginaw Bay, the biology of the lake trout in Lakes Michigan and Superior; and analysis of fishery statistics to show regional fluctuations in abundance and in fishing intensity.

Pacific Coast Fisheries

Investigations of the Pacific pilchard resource during the year were on a curtailed basis under which it was possible only to analyze catch records and ages of fish in samples of the catch, upon which to base estimates of abundance and replenishment of the stock. During the closing months of the year, in cooperation with the pilchard fishing industry, an observer was at sea collecting data on sea conditions and incidence of pilchard schools. His observations emphasize the changeability of sea conditions and also the severe limitations on research at sea when conducted from boats which are engaged primarily on other tasks and which lack the trained navigating personnel and the special equipment needed to assay the important qualities of the sea water on the fishing grounds.

Investigations of pink salmon at the Little Port Walter biological station were continued throughout the year for the purpose of determining fresh water survival of the young salmon, the return of adult salmon to the spawning grounds, and the correlation between weather and temperature conditions and rates of survival and time of downstream migration. Operations at the station this year were unique in that all seaward migrant pink salmon were captured and marked before being allowed to continue their migration to the sea. The percentage of fresh-water survival this year was only 0.8 percent, considerably below the average for the past 6 years, and attributable largely to adverse temperature conditions prevailing in the stream during the incubation period.

Studies of the valuable Alaska red salmon were continued, principally in the Karluk River system and in Bristol Bay. The Alaska salmon industry has taken steps to intensify biological research in Bristol Bay and in southeastern Alaska through establishment of a well-financed research staff. The industry program will be carried on in cooperation with the Service to avoid duplication of effort and facilitate interchange of information and findings.

Increased abundance of herring in some areas in Alaska have made possible increased catch quotas. Mortality studies and other biological investigations of the species have been the basis of predications of abundance upon which the quotas are determined in advance of fishing seasons.

Management of Shellfisheries

In oyster studies made in close cooperation with the Maryland department of tidewater fisheries, the Service has continued its investigations of the biological and ecological conditions on the principal public reefs in the Maryland part of the Chesapeake Bay. These studies have included the composition of the oyster population, growth, time of spawning and setting, and environmental factors concerned in the management of public reefs. From the data obtained, a program of State management has been recommended and is being followed with the result that increased oyster production seems assured.

Current advice was given to the industry engaged in the private cultivation of oysters in New England, by the distribution of bulletins on the progress of oyster spawning and setting, on the prevalence of oyster enemies, and on the better handling of oysters in their cultivation. Studies were made of feeding and growth and the effects of environmental changes on the physiology of oysters, particularly the effect of salinity changes, an element of extreme importance to those engaged in oyster production in the Gulf of Mexico.

Preliminary plantings of three different types of seed oysters at the cooperative experimental and demonstration oyster farm on North River have yielded marketable oysters of fine quality and size on barren bottom areas, many thousand acres of which are available in North Carolina for the cultivation of this shellfish.

The parasites of oysters were studied to determine their distribution and the extent of damage they inflict, as well as to obtain information leading to the application of adequate control methods. A microscopic parasite of the oyster, *Nematopsis ostrearum,* which may cause paralysis of the shell muscle, is transmitted to healthy oysters by small mud crabs. Control of this parasite by the destruction of the mud crabs on public and private oyster beds is being studied.

Extensive pollution of coastal waters with industrial wastes and sewage constitutes a serious problem of the oyster industry. Bacteriological studies on the trend of domestic-sewage pollution and its spread in the Hampton Roads area of Chesapeake Bay have been continued. These studies, which are of great importance in showing the need of sewage purification, reveal the extent of sewage pollution in that area before purification projects, planned to be completed in the near future, begin operation. Later studies will show the effectiveness of the purification plants and the importance of sewage treatment in increasing the grounds available for the growing of marketable oysters.

In connection with problems of pollution, studies were completed on the action of chlorine on oysters and the effects of sulfate pulp-mill wastes. Investigational work on the effects of DDT on the oyster industry was undertaken.

The biological laboratory operating a terrapin hatchery at Beaufort, N. C., produced, during the fall of 1945, a total of 12,770 diamond backs providing a supply of 11,370 young for distribution in five National Wildlife Refuges and other coastal areas from Virginia to Georgia.

Conservation of Alaska Fishery Resources

Managing the Commercial Fisheries

In Alaska the Federal Government, through the Fish and Wildlife Service, exercises direct jurisdiction over the fisheries. To assure a continuation of high yields from this most valuable of Alaska's natural resources, and at the same time to guard against excessive exploitation, vigilant control is necessary.

The value of the contribution of the Alaska fisheries to the recent war effort is emphasized by the fact that 80 percent of the salmon pack for 1945 originally was earmarked by the Government for military needs. This quota was reduced substantially, however, as the season progressed and the favorable turn of the war reduced food requirements for military purposes.

The fishing industry was again handicapped by shortages of materials and manpower, although in 1945 the lack was less critical than in other recent war years. For the third successive season, operations of the salmon canners were concentrated under a program sponsored by the Office of the Coordinator of Fisheries, permitting a more efficient use of available labor and equipment. But in some areas disappointing runs of salmon resulted in one of the smallest packs in recent years. Herring, on the other hand, continued to increase in abundance in the principal producing areas, making possible a liberalization of the catch quota for this species. The condition of other Alaska fishery resources, with few exceptions, was good.

Revised regulations for the protection of the commercial fisheries were issued by the Secretary of the Interior on March 27, to be effective in the 1945 season. The regulations provided for an increase in the herring catch quota, but restricted commercial salmon operations in Bristol Bay, the most important red salmon area, to about 50 percent of normal capacity. This curtailment was necessary to provide additional protection for the weak cyclical run which occurs there in the years divisible by five.

The Director of the Fish and Wildlife Service spent a number of weeks in the Territory giving personal attention to problems of fishery management. Seasonal opening and closing dates, areas open to fishing, and gear restrictions, were adjusted to permit additional catches where circumstances warranted.

Fishery patrol facilities including 11 patrol boats, 7 speedboats, 14 launches, and 4 open boats were used for protecting the fisheries. Vessel patrol activities were supplemented effectively by Government-owned and chartered airplanes. Personnel engaged in Alaska fishery protective work numbered 125, including fishery management agents, stream guards, weir operators, vessel crews, wildlife agents, and airplane pilots who assisted in this work.

Periodically, throughout the season, surveys were made to determine the extent and condition of the salmon runs and to assemble other information as a basis for modifying the regulations. Weirs for counting the escapement of spawning salmon and obtaining biological data were operated in six representative streams.

The Fur-Seal Resources

The Pribilof Islands fur-seal herd, which comprises 80 percent of all the fur-seals in the world, is managed by the Fish and Wildlife Service for the profit of the American public. Since 1910, when Federal control of this resource was assumed, seal skins and other products have brought into the Federal treasury more than 8 million dollars.

The annual census of the fur-seal population, taken in August 1945, showed that the herd contained 3,155,268 animals, an increase of 7.11 percent over the preceding year. In 1900, there were only about 17,000 animals in the herd. The 1945 season produced 76,964 fur-seal skins and in the winter season of 1945–46 the fox take—which is incidental to sealing—aggregated 1,296 blue and white skins.

The Alaska fur-seal herd has been affected very little by the war, although it was necessary, for military reasons, to suspend operations on the Pribilof Islands in 1942. The wisdom of the management program administered by the Fish and Wildlife Service is evident in the continued growth of the herd and the upward trend in the number of fur-seal skins taken each year, as shown by the following table:

Year	Sealskins obtained	Animals in herd	Year	Seaklsins obtained	Animals in herd
1930	42, 500	1, 045, 101	1938	58, 364	1, 872, 438
1931	49, 524	1, 127, 082	1939	60, 473	2, 020, 774
1932	49, 336	1, 219, 961	1940	65, 263	2, 185, 136
1933	54, 550	1, 318, 568	1941	95, 013	2, 338, 312
1934	53, 470	1, 430, 418	1942	150	2, 585, 397
1935	57, 296	1, 550, 913	1943	117, 164	2, 720, 780
1936	52, 446	1, 689, 743	1944	47, 652	2, 945, 663
1937	55, 180	1, 839, 119	1945	76, 964	3, 155, 268

The growth in the size of the fur-seal herd in recent years, and the increasing scope of sealing operations at the Pribilof Islands present management problems of immediate concern. These include the determination of the optimum size of the herd, the relation of the fur-seal herd to the commercial fisheries, variations in mortality rates, and studies of migration routes at sea. Another problem has to do with replacing and enlarging plant facilities on the Pribilof Islands to keep pace with the growth of the herd.

With the end of the war, plans are being made to resume biological investigations to provide, among other things, an index to the number of surplus animals to be killed each year; also information will be developed that will be generally applicable to the conservation of the fur-seals of the North Pacific.

Utilization of Fishery Resources

Promotion of the greatest possible utilization of our aquatic resources is a direct means of conservation, for the more completely the catch of fish and shellfish can be utilized, the less will be the required drain on the resource to satisfy our needs. The Fish and Wildlife Service is therefore concerned with promoting full utilization by the conduct of statistical, technological, marketing, economic, and educational research and services.

Statistics on Production and Marketing

To meet the needs of the fishery industry for current information on market conditions, the Fish and Wildlife Service issues daily releases on production, stocks, prices, movement, and general market conditions. This information is collected and published by eight Fishery Market News Service Offices, strategically located in important production and consuming centers over the country. The addition of two new offices during the past year makes possible coverage on a Nation-wide basis. Utilization of these daily reports by the various sections of the fishing industry has been greater during the past year than at any time since this service was initiated.

This daily market information is augmented by publication of the results of monthly and annual statistical surveys, planned to assist the fishery industry in efficient and economic operation. Such surveys include data on employment, yield by species of both raw and manufactured products, gear operated throughout the United States and Alaska, prices of fishery commodities, and detailed data on quantities of fish frozen and held in cold storage.

Because of the great interest in the production of fish meal and oil, both of which have continued to be in short supply, a monthly report on the yield of these important products was added to the regularly published bulletins.

Publication of the Service's annual digest, "Fishery Statistics of the United States," was resumed during the year when the 1942 edition was sent to the printer. Shortages of personnel and funds had made it impossible to publish this report during the war.

Sanitation in Fish Processing Plants

Fish is one of the most difficult of food products to handle from the standpoint of sanitation in processing plants. Elimination of flies and other vermin being the first requisite of sanitation, the Service has thoroughly explored the adaptability of some of the newer insecticides for use in food processing plants. During the summer of 1945 an intensive sanitation campaign was waged against the common house fly, using residual sprays of the insecticide DDT in and around processing plants. A specific request was received from the industry at Crisfield, Md., for assistance in eliminating flies in the fish and crab meat processing plants of that city. This operation was undertaken with the assistance of the Bureau of Entomology and Plant Quarantine of the United States Department of

Agriculture. Not only were the processing plants sprayed, but instructions were furnished to the entire population of the city for handling the spray, equipment, and material, with the result that home owners and merchants in the city cooperated in the program. About 10 days after the completion of this treatment a spot survey indicated a reduction of approximately 98 percent in the fly population. Methods of applying this insecticide were demonstrated in processing plants and wholesale and retail establishments in New York City and Boston. These services and other sanitation and quality studies will be continued next year.

Research on Containers for Fishery Products

Since the earliest attempts to freeze fish and hold it in cold storage, the industry has experienced difficulty in preventing evaporation of moisture and loss of quality by dehydration. This difficulty is the result of qualities of composition and structure inherent in the flesh of fish. In an effort to discover a suitable container for frozen fish, Service technologists have investigated many treatments and wrapping materials without finding one that is entirely satisfactory. Some of the war-developed plastics are now being investigated to determine their effectiveness as protective coverings for frozen fishery products.

Transportation by air requires special methods of packaging and refrigeration for such perishable products as fresh fish, live lobsters and crabs, and various shellfish. Since air shipments of seafoods is a new venture, still in the experimental stage, little knowledge of the requirements of these products was available, and it has been necessary to make a large number of tests of the various types of containers. These studies are progressing satisfactorily; some recommendations have already been made to manufacturers of containers as well as to air transportation companies.

Research on Sources of Vitamin A Oils

During the early months of 1945 landings of soupfin shark livers declined to a point insufficient to maintain the high production of vitamin A liver oils necessary for civilian as well as Government demands. Research designed to reveal supplementary sources revealed significant facts about the grayfish or dogfish, a small shark long known to yield vitamin-A-bearing oils. The size or age of the grayfish was found to have a definite bearing upon the quantity and quality of the vitamin A oil contained in the liver. On the basis of these findings it was recommended to the industry that no grayfish under 30 inches in length be taken, since it is not only uneconomical to process the livers from smaller dogfish but wasteful from the standpoint of conservation. These recommendations were accepted.

Economic Research and Services

In order to promote the efficient functioning of the fishing industry as an integral part of the whole economic system of the United States, the Fish and Wildlife Service employs a staff of economists to make basic studies of such matters as employment and labor problems in the fisheries, price structure of the industry, and organization of cooperatives. Results of these surveys are published for the information of the industry. Included in the economic surveys made during the past year were the following: (1) Study of the purposes, financial structure, legal basis, and effects of cooperatives on the Pacific coast (2) surveys on State unemployment laws and compensation rates as they relate to fishermen and allied workers (3) analysis of the effect of strikes and other work stoppages on the economic conditions of the industry (4) studies of marketing agreements, subsidies, price-support programs, and parity prices in connection with their possible application to the fisheries (5) production and distribution costs on salmon, pilchard, mackerel, tuna, and shark fishing on the Pacific coast.

Development of Markets

The beginning of the postwar period found the fishing industry in an anomalous position. On the one hand it was unable to produce enough canned fish to meet demands; on the other its production of fresh and frozen fish had reached an unprecedentedly high level. Added to domestic supplies were increasingly large imports. This difficult situation could be met only by creation of wider markets. To assist in normalizing the marketing situation, the Service prepared market development bulletins and articles in trade publications, arranged demonstrations of fish cookery, worked with operators and patrons of refrigerated locker plants, and cooperated with the Department of Agriculture in releases to the press and radio.

Educational Services

During the closing months of the year, the framework of a fishery educational service was established in readiness for an extensive program to be launched during the fiscal year 1947. Such a program is indispensable to the future welfare of the American fisheries. If this industry is to compete successfully with other food industries and is to meet increasing foreign competition, it must have access to the most advanced knowledge of better fishing methods, improved processing, shipping, and distributing techniques, and adequate facilities for training personnel. The fisheries of many foreign nations have had the benefit of such services and are today producing fishery products whose high quality enables them to bid for world markets.

The National Park Service

By NEWTON B. DRURY, *Director*

AS MILLIONS of Americans, freed of wartime controls on travel, poured back into the national parks and monuments during the past year, they had the satisfaction of knowing that the National Park System had remained essentially the same as before the war. The virgin forests still stand; the scenic canyons have neither been blocked nor obliterated; the lofty mountainsides remain unscarred by mining. The great and cherished places of nature and of human history still present what is best and most inspiring of the American scene.

With the return of peace we believe that there are few who would contend that the parks should have been sacrificed, or materially altered except as a last resort. We know that there are many who are profoundly grateful that the war did not bring us to such extremity, and that the resources of the parks have been kept intact in the face of demands for their utilization for war. It is gratifying to record again the fine understanding of park values that so many officers of the Army and Navy and other war agencies possessed, and their willingness, and genuine desire, to turn to other fields for critical materials and lands whenever it could be shown that the needs of a Nation at war could thus be met.

This first year of postwar operations in the National Park System has involved a process of reconversion and of resumption of normal activities and responsibilities that proved fully as difficult and vexatious as was anticipated when the lifting of travel restrictions last August set millions on the road. Travel returned immediately—and somewhat surprisingly, considering the general condition of automobiles and tires—to normal and higher-than-normal volume. The process of adjustment to it, however, was slowed by an insufficiency of personnel, both in the National Park Service and concessions; by the deterioration of both the Government's and the concessioners' facilities; and by the serious shortage of equipment. Reduced to hardly more than a custodial basis during the war, with many regular functions either greatly curtailed or entirely eliminated, the field organizations—those charged with on-the-ground management of the parks and monuments—have made an effort to meet the demands made upon them that deserves full recognition.

1946 greatest travel year.—The floodgates of travel opened immediately after VJ-day. For months thereafter all previous monthly records for numbers of visitors were broken; parks whose remoteness had rendered them inaccessible to all but a handful of visitors during the war were suddenly hosts to great crowds for which neither the park staffs nor the concessioners were prepared. Nor was it possible, in many instances, to make adequate preparation for many months thereafter.

Travel figures for the National Park Service are based upon a travel year which extends from October 1 to September 30 of the following year. It is anticipated, on the basis of the number of visitors thus far, that the 1941 record of 21,050,426 will at least be equalled and probably will be surpassed. During the fiscal year which ended on June 30, attendance at all areas in the system was 16,086,947.

In general, visitors understood the difficulties under which both the Service and the concessioners were endeavoring to care for them, and most of them accepted cheerfully the inconveniences of a period of reconversion. There were complaints, of course, but the number was infinitesimal in comparison with the millions who were happy to have an opportunity once again to visit the national parks.

Personnel insufficient.—When the ebb of wartime travel turned to the flood last August, the roll of regular employees of the Service contained approximately 1,575 names. During a fall and early winter period which saw all previous attendance records broken, both personnel ceilings and lack of funds prevented any material increase in that number. A measure of relief was obtained when a supplemental appropriation of $357,650 became available on January 1. This permitted the Service to restore former employees to the rolls as they were discharged from the armed forces or were released by other war agencies or industries, though it did not meet adequately the needs which arose so suddenly with the coming of peace. By June 30, there were 1,795 permanent employees on the regular rolls, and to these had been added 1,524 temporary employees.

The total number of employees paid out of funds directly appropriated to the National Park Service on the latter date was approximately the same as were on the rolls during the 1941 season. It would be natural to infer from this that employment had returned fully to normal. That was very far from being the case, however, for two very important reasons.

During the 8 years that preceded the war, virtually all of the ordinary maintenance work in many of the major areas of the park system, including that required for the many new facilities made possible by Civilian Conservation Corps and other emergency construction agencies, was performed by CCC enrollees, under the direction of CCC foremen. It would be extremely difficult to estimate what this assistance amounted to annually, but several thousand enrollees and supervisory personnel were thus occupied. Today, all the maintenance work they formerly performed is thrown back upon the regular forces.

Figure 6.

And these forces themselves were materially reduced, in effect, by the establishment of the standard 40-hour week for all Federal employees. Employees in the parks formerly worked a 48-hour week, so that this change was approximately equivalent to a decrease of one-sixth in their number, not to mention the other complications which have resulted from its application to operations which, for most areas, are in full swing 7 days a week through much or all of the year.

Many employees have loyally and voluntarily worked much more than the prescribed 40 hours per week without extra compensation. They saw that certain work had to be done, both to serve the visitor and to supply needed protection to the public properties for which they were responsible.

Concession Service Rendered Under Difficulties

The unprecedented wave of travel to the national parks following the war created a host of problems for the concessioners who contract to operate visitors' facilities. Their operations had been drastically curtailed and in many instances entirely discontinued during the war, particularly the hotels and transportation service. Reconversion to peacetime operations involves repairs and improvements the need for which has accumulated over 5 years and which still lags through insufficient supplies of materials, labor, busses, food, and needed specialized equipment. One great handicap in attempting to resume service on a prewar basis has been the lack of experienced personnel. The 5-year break in normal operations, plus war service of many employees, drained off the efficient personnel that had returned annually to form the nucleus of the summer operating staffs, and provided for no training of replacements. Considerable confusion inevitably resulted from the employment of inexperienced help. Under these conditions, the park concessioners acquitted themselves very well, and the visitors were sympathetic with their difficulties.

As happened in the great majority of hotels throughout the country, park concessioners were flooded with requests for advance reservations that far exceeded any peacetime experience. With untrained people handling reservations there were at times unavoidable lapses in service. Although there were some complaints, the number was small in comparison to the total volume of work handled. In one of the most widely-visited western parks, 10 new employees took over the reservations work that formerly had been handled by 2 experienced clerks and yet were unable to keep the volume current. As additional housing could be opened and manned, it supplemented in midseason and fall the various wartime accommodations, and bus service was resumed with such equipment as had not been transferred to war-connected industries. Admittedly, facilities and services to the public during 1945–46 were not—and could not be—up to the usual park standards.

Record registrations and applications for hotel and lodge accommodations made it necessary in the national parks, as in most of the hotels throughout the country, to limit the stay of guests at some parks in order to provide accommodations for the greatest possible number of visitors. No uniform stay limitations were imposed because of the varying conditions existing in different areas. In those parks having the heaviest concentration of travel, as at the South Rim of the Grand Canyon where the requests for reservations far exceeded the accommodations available, stays at hotels and lodges were limited to three days, no exceptions being made even for persons who annually made advance reservations covering periods ranging from a month to the entire summer. Much of the travel in the fall and winter was composed of members of the armed forces who were still taking the opportunity to visit national parks as leave and travel conditions permitted; and the concessioner and Service officials alike made maximum efforts to care for these visitors.

Facilities returned by the military.—All concession facilities used by the armed forces during the war, including the Ahwahnee Hotel in Yosemite National Park, the Arlington and Majestic Bath Houses in Hot Springs National Park, and Frijoles Lodge in Bandelier National Monument, were returned to the concessioners for civilian use. Rehabilitation of the Ahwahnee Hotel, which had been remodeled and refurnished when it became a naval convalescent hospital, had not been completed by the end of the fiscal year.

Rates.—Some increases in costs to the public were made early in the year to offset the price of labor and food supplies. Approval of new rates by the National Park Service was subject to the regulations of the Office of Price Administration. In arriving at the schedules to be submitted for the 1946 season, one major park concessioner last fall planned on increases above the 1941 levels of approximately 40 to 50 percent in salaries and wages of employees, the latter largely of the temporary type. The law of supply and demand entered the picture, however; and when the season opened this operator found it necessary to pay approximately 90 to 150 percent higher wages to his new and inexperienced hotel and lodge employees than he had in 1941. Rates in the parks have not kept pace with rising costs, and in general they compare favorably with those of like outside enterprises.

Wage and hour studies.—A proposed revision in the wage and hour regulations for concessioner employees has been studied, and recommendations on new regulations will be submitted for the approval of the Secretary at an early date. The regulations, among other things, will provide for a Board of Labor Review to pass on the basis of employment of all concessioner employees.

The Western Conference of National Park Concessioners met in Chicago on December 3 and 4, 1945, with many members of the Director's staff attending certain of the meetings. Among the topics discussed were return to full prewar operations, wage and hour regulations, extension of the operating seasons in the parks, winter operations, the possibility of overstimulation of travel as a result of advertising, and the apparent need to limit length of stay at hotels and lodges.

National Park Concessions, Inc.—This nonprofit distributing corporation continued to furnish concession facilities at Mammoth Cave (Ky.), Isle Royale (Mich.), and Olympic (Wash.), National Parks. It initiated operations in Big Bend National Park in Texas, in accordance with previous arrangements, and prepared to reopen facilities on the Blue Ridge Parkway which had been discontinued because of the war.

A review of the concession policy.—Some phases of the concession policies and practices of the National Park Service were sharply criticized by the Interior subcommittee of the House of Representatives Appropriations Committee when the 1947 Interior Department appropriation bill was reported to the House, after having been the major subject of discussion during the preceding hearings. This criticism was given considerable newspaper publicity, including the comment of at least one syndicated columnist. It has led to careful analysis by the Service of concession practices. Because the Service believes that this criticism was the result of insufficient knowledge of the "how and why" of national park concessions, and the difficult problems involved, there is justification for including in this report the significant facts as to the origins of the concession system and the conditions under which concessions must be operated.

At the outset, these facts need to be borne in mind:

The Federal Government, except in few instances, does not own the buildings and other public accommodation facilities in national park areas. The Congress has never given approval to a general policy of Government ownership of these facilities though many members favor it.

That being the case, it has been necessary to enlist private capital to provide accommodations. Authorization for this procedure was contained in the earliest national park act—that which established Yellowstone National Park in 1872.

Owners of private capital, generally speaking, have erected the buildings, furnished transportation equipment and provided the organization necessary to care for the public staying in the parks. Some have sought this business opportunity; others have been induced to undertake it. In either case, they have not invested their money in these provisions for the public in the parks without a reasonable expectation of fair earnings and the ultimate amortization of their investment.

Existing law forbids concession contracts exceeding 20 years in duration. Since the useful life of such substantial structures as the concessioners are expected to provide is normally more than 20 years, and since Internal Revenue regulations in many cases preclude writing off the investment in this period, this limitation, instead of being for too long a period, as is sometimes claimed, is in reality too short from the standpoint of the investors of private capital on these Federal lands. It compels either an unreasonably high allowance for depreciation, which usually cannot be allowed, or an implied understanding either that the concession contract will be renewed at the end of the 20-year period or that the Government will give the concessioner an opportunity to recover the remaining value of his investment when the contract expires.

If the Government were to acquire the facilities which are normally operated through concessioners, operation, through concession contracts, would have to be on one or the other of two bases. One would be that it should produce a sufficient return to the Government to meet reasonable interest charges and to amortize the investment during the expected life of the structures. The other would be consciously to permit a lower return and the absorption by the Government of some portion, at least, of this investment, because of the social benefits accruing to the public as a whole, with operation at something less than the cost of rendering the service. In other words, a subsidy. Since only a small percentage of the whole public actually utilizes the facilities, it is doubtful if an adequate case could be made for the second course. In general, it would seem logical that rates for special services such as hotel accommodation, meals, and transportation, even if the plant were Government-owned, should be set at levels calculated to amortize the investment in facilities within the period of their useful life, and afford the operating agencies reasonable compensation for their services.

Operation of concessions in the National Park System has not always resulted in profits to the stockholders. The average return of all concessions in the past 7 years has been under 3 percent. Even in the case of those which have operated at a greater profit, that profit, in most cases, could hardly be considered more than a fair return on the investment, considering the hazards of the business.

For national park concessions operate under a number of serious difficulties and handicaps which are by no means common to similar or related undertakings elsewhere. These justify classifying the investments involved as highly speculative. All are subject to heavy seasonal fluctuations in volume of business; some have periods of less than 2 months of operation at approximate capacity, though burdened with heavy carrying charges throughout the year. Most of them are distant from sources of supply of such things as foods, most building materials, and competent help. Many can maintain only a nucleus organization during the greater part of the year and are compelled to recruit most of their employees seasonally. They are, furthermore, closely regulated by the Government with respect to rates, service, management, and construction of facilities, and are often compelled, in the public interest, to carry on certain lines of unprofitable business. And while the private enterpriser outside of the parks can determine the amount of any kind of accommodation he may wish to supply, the park concessioner is compelled to be ready to meet with reasonable adequacy the needs of the public on all but the peak-load periods of the season, such as the Fourth of July holiday and the Labor Day week end. All of these factors materially affect the cost of concession operations, their rates, and their attractiveness to private capital.

However, the Federal Government, recognizing its responsibility to meet the basic needs, comfort and convenience of visitors has adopted the only course open to it—the recruitment of private capital on terms that would attract such investment. The National Park Service has long contended that the facilities required to meet this responsibility, if they are to be established within the parks, should be in Federal ownership. The existence of a private vested interest, even though temporary, is basically undesirable, even though it has congressional sanction of long standing. Federal ownership, coupled with actual operation by a competent and carefully chosen concessioner, should make it possible to provide needed services more cheaply. Money costs the Federal Government less, insurance would be unnecessary, and depreciation allowances (made for cost calculations only) could be accurately related to the expected life of structures. Government ownership would have the further advantage of wider latitude in selection of desirable operators than is possible when a considerable private investment has to be taken into account.

Only in a small minority of instances are the concession facilities now in Federal ownership, and in only one of these, Mammoth Cave National Park, can the operation be considered of major importance. At present, housing, meals, transportation, retail stores and other services are furnished in the various areas of the system under 85 concession contracts. The investment of several of the concessioners amounts to several millions of dollars. Developments placed on park lands by private capital have cost more than $29,000,000. With them, a necessary and useful function has been performed, and the companies performing them have, with rare exceptions, been animated by the desire to serve the public well and fairly. If we were to start over "from scratch," some kinds of facilities that now exist would not be reestablished; others would be placed in different locations; but, on the whole, the concessioners have met a real need, which could not have been met otherwise, and have done it well.

With the approval of the Secretary of the Interior, plans have been made to appoint a committee of experts to make an early and dispassionate study and appraisal of national park concession procedure, and to formulate recommendations for its improvement.

Background of park concession policy.—Concessions, and the need for them, extend back far beyond the establishment of the National Park Service 30 years ago. They go back, indeed, to the beginnings of national park history. The Congress, unwilling in those earliest years even to provide for park maintenance and protection, included in the Organic Act of March 1, 1872, establishing Yellowstone National Park, a provision authorizing the Secretary of the Interior in his discretion to "grant leases for building purposes for terms not exceeding ten years, of small parcels of ground, at such places in said park as shall require the erection of buildings for the accomodation of visitors * * *." Ten years proved too short a period to enable private companies to install the proper types of accommodations and furnish regular service with any assurance of a fair return upon their investment. The result was a chaotic situation, as hotel competed against hotel and agents of various transportation companies hounded prospective passengers. Park visitors were the sufferers from the mismanaged and competing concession operations. While on vacation the average American neither likes to be beseiged by representatives of various caterers to his comfort nor to take time to shop around on the ground to secure the lowest rates.

To insure greater stability of investment and operation, the Congress in 1907 amended previous authority to permit the issuance of concession leases for periods not to exceed 20 years. Later acts, including that creating the National Park Service, carried a similar provision.

Even before the establishment of the National Park Service, when the late Franklin K. Lane appointed Stephen T. Mather (later to become first Director of the National Park Service) as Assistant to the Secretary, in charge of national parks, the concession problem came in for critical analysis. Mr. Mather worked unceasingly to improve concession service through the making of more favorable contracts, elimination of undesirable services, enforcing contract provisions more consistently than had been possible previously, and studying types and locations of accommodations. His successors, Horace M. Albright and Arno B. Cammerer, likewise devoted much time and thought to the concessions system, realizing its importance in assuring public enjoyment of the parks.

It was not always easy to interest private capital in establishing adequate, dependable tourist facilities. In several instances, Mr. Mather appealed to businessmen in communities near certain parks to develop necessary accommodations as a matter of civic pride, in the face of dubious prospects of profit.

A particularly troublesome concession problem has been that of transportation. In at least two major national parks, Mount Rainier and Rocky Mountain, competition threatened an impossible situation in the early days of the National Park Service. "Jitney" operators of one type or another demanded the right to transport visitors from railheads to hotels. However, the park concessioner, operating under franchise from the Federal Government, was compelled to furnish service during the operating season, whatever the weather, for one passenger or a carload. Dependable regular service was guaranteed by this contract with the Government. On the other hand, the irresponsible operator of jitney service made hauls in good weather and at times of peakloads, thus depriving the concessioner of an opportunity to make a profit to offset the losses sustained when travel was at low ebb. The unlicensed competitors sought to take the cream of the business, but with no guarantee of service.

Every effort has been made to solve this problem fairly and in the public interest. Years of experiment and experience had proved the impossibility of assuring satisfactory service under conditions of unregulated competition. The alternative which seemed most likely to produce adequate facilities and service for the visitor and to attract concessioners willing and able to assume continuous responsibility for such service was one under which at each area a single well-financed operator provided each type of service, and sometimes several types, under conditions and at rates regulated by the Government. This policy, now of many years standing, has resulted in a degree of reliability of service that appears to have justified it.

Start toward Government ownership of facilities.—A beginning in Government ownership of concession facilities was made in the middle 30's, when it became possible to construct several small concession units with funds and labor contributed through emergency construction programs. These were owned by the Government, but operated by private concessioners.

The most significant development along this line, however, came in 1941, with the formation of a private nonprofit distributing corporation known as National Park Concessions, Inc., to operate the hotel and other facilities for visitors at Mammoth Cave National Park. The physical properties had come into the possession of the United States when they and the lands upon which they are located were donated to the Federal Government for national park purposes.

Another nonprofit distributing organization, Government Services, Inc., has also become interested in the operation of federally owned national park concession properties. A strong organization that has been in existence for more than a quarter of a century, it operates cafeterias, newstands, and similar services for Federal workers in Government buildings in Washington, D. C. Well-financed, it is in a position to branch out into other fields.

This type of operation has thus far proved satisfactory from the standpoint both of the public and of the National Park Services. It remains to be seen whether in the larger enterprises it will prove as satisfactory as have been the operations by experienced private concessioners.

Beset by the increased difficulties that surround any operations involving labor, food, and materials under present conditions, and aware of the Department's avowed long-term policy of Government ownership of all fixed assets within the parks, some of the larger and older concessions have indicated a willingness to sell their equity. During the war, one concession corporation offered its facilities for sale at a price of around $2,000,000.

Unfortuantely, no Federal funds could be obtained to buy the properties outright; nor were the nonprofit distributing organizations which were nterested in acquiring and operating the concession able to arrange the necessary loan. Negotiations are again under way to obtain a loan for this purpose, with the full support of the National Park Service.

Visitors to national parks are there as guests of the Federal Government. It is the obligation of the Government to see that they are properly treated, get the service they are entitled to, enjoy themselves, and are not overcharged. Until the Government will make the basic investment, the National Park Service hopes to select concessioners that are amply financed to install the facilities, are able to conduct the business in a sound manner, will work closely with the National Park Service, and have sympathy for and understanding of its policies and its obligation to serve the public.

The Problems of Winter Use

Many national parks are unusually beautiful in their winter mantle of snow and ice. A winter visit is a rare experience. Winter sports are exhilirating alike to participant and spectator. The National Park Service is deeply interested in encouraging as much use as possible that does not involve injury to the parks or undesirable commercial or promotional aspects.

Use of most of the parks was curtailed during the war more drastically in winter than at other seasons of the year, since war-caused shortages of funds, personnel and equipment, affecting both the Service and the concessioner, made operation even more difficult than in normal times.

The Service has been devoting special effort to the development of sound winter-use policies. Conferences with members of ski and other outdoor organizations have been a part of that effort, and careful consideration has been given to all their suggestions and their criticisms of the Service's policies. Secretary Krug has indicated that, as funds and facilities become available, the parks should provide wider opportunities for winter enjoyment.

Accommodations.—Among the factors foremost in determining the extent of winter use is that of accommodations. At parks like Crater Lake, Mount Rainier, Lassen, Yosemite, and Sequoia, the majority of the winter sports enthusiasts are in the parks only during the daytime. But there is growing pressure for overnight accommodations and meals, particularly over the week ends. This presents serious financial and operation problems. Cabins suitable for summer have proved inadequate and dangerous, if at all usable, in winter, partly because of the impossibility of heating them adequately and partly because they are not safe under the heavy snows in the high mountain areas. Paradise Inn, at Mount Rainier—long a winter-sports mecca—is a building of several stories, yet frequently it is all but covered by drifting snows which at times have reached the ridge of the building at the gable end, a depth of 60 feet. Caring for the public costly and difficult under such conditions. It is highly hazardous to hou large numbers of guests in winter in a timber building covered with sno and having few exits. Buildings for winter use should be fireproof ar strong enough to stand the heaviest snow loads.

In addition to the heavier fire hazard under winter conditions, tl problem of heating is an abnormal one. Even during the summer tl hotels in the more northerly parks require heating. To maintain warm in winter at such altitudes means heavy fuel costs and substantial co struction.

All these facts make it obvious that providing sleeping accommodatio in the national parks is much more costly in winter than in summer.

In winter, the problem of peakloads, serious enough at other season is intensified because nearly all patronage is concentrated on weekends an holidays, yet it is necessary to keep up operations throughout the wee and every week. Experience has shown that, in some parks, to require th concessioner to maintain the normal standard of public service during th winter means reduction in earnings to a point where the concessioner migh well decide to withdraw. The Rainier National Park Co., for example, fu nished winter accommodations at Paradise Valley for a number of year but always at a loss. Largely as a result of this service, the company has bee fairly consistently in the red on its annual operations. Inherent in an operations there, under the weekend peakload that prevails, is the difficult of obtaining dependable or sufficient employees when needed, without heavy pay roll during the remainder of the week with little or no patronag At Mount Rainier and elsewhere attempt is being made to work out practical method of furnishing overnight accommodations to the greates extent justified by conditions.

Parks never closed.—No national park is officially closed during the winte in the sense that gates are barred or visitors prohibited from entering. Th seasonal dates, frequently called the opening and closing dates of the nationa parks, refer only to the operating season when concession accommodation are fully available. Such closing as does occur is the result of heavy snow that block access roads or entrance to certain high mountain areas. Eve those most difficult of access, however, are as available to the moder traveler as they were to those of earlier days. But for the modern travele living accommodations and roads in these wilderness areas appear to hav become necessities.

Needed for increased winter use is a larger permanent staff of rangers Protection of visitors and rescue and first-aid work, including not infrequent need to take out the victims of skiing and other accidents on rescu toboggans, is a heavy responsibility resting upon the National Park Servic when it invites the public to use the parks in winter.

Use during past winter.—Before the war, skiing and other winter sport were exceedingly popular in the mountainous areas, particularly i osemite, Mount Rainier, Sequoia, Rocky Mountain, Crater Lake and assen Volcanic National Parks. The only national park able to function lly on a winter basis in 1945–46 was Yosemite. During two war winters, hen the Service was without funds to open the road to the famous Badger ass ski area, the public benefited from the fact that the Navy Department nanced the clearing of this road for the benefit of convalescents at the naval ospital then maintained in the park. Last winter skiing hit an all-time igh in Yosemite, with 81,770 visitors at Badger Pass, as compared with 4,000 in 1940–41. During the season from December to April inclusive, 05,832 persons entered the park.

Much of last year's criticism of the Service's winter use policy was caused y the fact that at the beginning of the winter season, the road to Paradise alley in Mount Rainier National Park was not opened. It could not be, s the National Park Service was still operating on a war-time budget and e Congress had not yet provided funds for snow removal. Heavy snowall closed the road to Paradise about November 15. A fund of $11,500 arried in a supplemental appropriation, made it possible to undertake ork in midwinter to reopen it. By that time the snow was hard-packed, o that dynamiting was necessary on the upper sections; and progress was lowed by stormy weather and heavy snows. The road was opened to traffic n March 3. In no other park, however, were extra funds provided for now removal until July 1, 1946.

Danger of slides.—Snowslides are an ever-present element of danger n connection with the Paradise Valley winter sport center. As the road limbs to the Valley, cars pass through towering snowbanks. Behind these anks is the weight of snows on the steep slopes above them, always potential ources of devastating slides. Thus far, no serious accident has arisen from his cause; but the public should know that park staff and visitors alike are n some danger every time they drive between the deep walls of snow and he Service must take this into calculation in planning winter use there.

The demand for winter-use areas at Rocky Mountain National Park was uch heavier last winter than before the war. Skiing facilities there have een of the simplest types, designed for daytime use only. New interest in he extension of winter activities in the park and in nearby communities as resulted in studies by communities and civic organizations to find areas uitable for winter development, including overnight accommodations. Similar studies are to be made in Olympic National Park.

Sequoia National Park, and the Grant Grove section of Kings Canyon National Park, had all-year use prior to the war. The closing of accommodations for visitors has restricted such use during recent years, but it is expected that winter facilities will be available again during the coming snow season.

Crater Lake has splendid scenic and recreational attractions both summer and winter and excellent possibilities for snow sports. Last spring a plan was announced to establish park headquarters near the south entrance, at a lower elevation than the present headquarters. This is a logical step in the development of Crater Lake into an all-year park. During the war years, and last year, it had to be closed during the winter since snow removal there is an especially costly item.

Yellowstone National Park has never been an important winter-sport center, because of location and weather conditions, but it provided a thrilling wildlife spectacle in pre-war years along its Cooke City Road and elsewhere. Guided wildlife trips in winter should be resumed as soon as fund and conditions permit.

Developments being planned.—The Service is interested in encouragin informal skiing, snowshoeing, ice skating and tobogganing in which all, skilled or unskilled, may participate if they so desire. This use should be on the same basis as summer use—noncommercial, suitable to the area in which made available, involving no undue disfiguration of importan landscapes, and appealing to active, vigorous outdoor people who particularly enjoy indulgence in winter sports in places of scenic beauty.

Development of adequate winter facilities is being planned for all park where conditions justify it. This is no simple task; it will require a high degree of cooperation by all those concerned, and a sympathetic understanding of the many and serious difficulties involved. The subject ha been treated at some length in order to promote that understanding.

Since funds for snow clearance will be available during the coming winter, day use can be assured in most of the areas of heavy snowfall. The provision of overnight accommodation remains the still-unsolved problem in several of them, however. Concessioners cannot be expected to operate for long at a loss. Nor should summer visitors be expected to pay rates high enough to compensate for winter deficits. Thus while winter accommodations are no problem where experience has shown them to be profitable, they can be furnished in others only if the individuals or groups who use them are willing and able to pay rates which can cover the higher costs of winter operation or if it is decided that the Government should meet a part of the extra costs ordinarily borne by the concessioner. The later course might be followed if the Government were to provide light and heat, water and sanitary service, and perhaps some form of maintenance of the buildings used for overnight accommodations. Such a program would require enabling legislation. The extent to which it should be done is a matter of policy for the Secretary of the Interior, the Bureau of the Budget, and the Congress to decide.

Private Lands Still a Major Handicap

At the close of 1946, the critical problem, or group of problems, posed by the presence of more than 600,000 acres of non-Federal lands within the boundaries of national park system areas remained unsolved. The request for a modest $350,000, recommended by the National Park Service and approved by the Bureau of the Budget, which would have permitted the service to begin a land acquisition program, was disapproved by the Appropriations Committee of the House. Pleas for its inclusion by the Senate committee were no more successful. The unwillingness of these committees to authorize any land purchase funds except the $30,000 needed for the Montezuma Well property in Arizona, is largely explainable by the opposition of western members of Congress to the removal of further lands from the tax rolls. This fact emphasizes the disadvantage under which the Service labors, by comparison with other Federal agencies which are permitted to return a portion of their income for the support of local units of government.

The large amount of non-Federal land inside the national parks and monuments over which the National Park Service has no control is a constant threat to the integrity of these areas and a serious impediment, in many cases, to sound development and economical, effective administration. It has been emphasized in the past, but deserves restatement, that delay in starting a regular, orderly program of acquiring these lands involves, at best, ultimate large increases in cost, both because of increased land prices and because of the expensive developments being placed upon them. At worst, it means that scenic and historic resources that should be preserved are destroyed or are so modified as to lose the character that gives them park value. In either event, the people of the United States are the permanent losers.

It is now estimated that between $1,250,000 and $1,500,000 annually for a period of as much as 20 years will be required to eliminate the non-Federal lands in the national park system. Meanwhile, every effort is being exerted to effect exchanges, where those are feasible, to accomplish a part of this needed program. Legislation which authorized exchanges with respect to non-Federal lands in Glacier National Park was passed during the closing days of the Seventy-ninth Congress, after the end of the fiscal year. The extent to which this authorization will prove useful is still problematical.

Protection Presents Varied Problems

Placing an area in the National Park System does not result automatically and inevitably in the complete preservation and protection of its natural and historical resources. The desire to log virgin timber or to utilize minerals, forage, and water does not die when these resources are embraced within park or monument boundaries. Periodically the cry about "locked-up resources" is raised by interested parties. Undesirable encroachments appear where too little land is included in a park or monument. Historic or prehistoric structures deteriorate if funds are inadequate for repair or stabilization or for employment of a sufficient protection staff. Endeavors in a few instances to give permanence to avowedly temporary military uses have presented an additional problem. Even the normal and legitima use of areas, particularly when concentrated and continuous, in such plac as public camp grounds, has a progressively destructive effect on plant li and on the soil itself.

The need of lumber for veteran housing was the reason given for the mo recent effort to have a portion of Olympic National Park returned t National Forest status, so that some of its virgin forest might be logge When the park was dedicated in June, Secretary Krug declared that Congress had decided that matter in establishing the park; that any change i the decision would also rest with Congress; but that any recommendatio of the Department would be based upon national rather than local considerations.

"I am convinced," he declared, "that such forest as that which giv Olympic National Park such outstanding distinction must be preserved, future generations of America are to have the privilege of savoring full and deeply its wilderness grandeur."

Mining interests oppose the proposal to eliminate from Joshua Tre National Monument minerally valuable lands amounting to approximatel one-third of its present area, and which the Department has approve Instead, they want all but 50,000 acres of this extraordinary desert are to be opened to mineral exploitation.

With the ending of the war, pressure for the wholesale invasion of th western parks and monuments to graze livestock has greatly decrease though stockmen and their organizations continue to favor the use of muc more park and monument land for this purpose. Meantime, existing grazing, covered by lifetime permits to those who had the grazing privileg in a number of areas at the time they were added to the park system, i being reduced very slowly. During 1945 it amounted to 101,315 anima months, a decrease of 5,704 from the previous grazing season. In severa areas, notably Saguaro and Organ Pipe Cactus National Monuments, grazing is proving very damaging to desert vegetation; at Saguaro, in fact, th giant cacti are almost bound to disappear if the practice continues, sinc it has prevented any new growth; while the necrosis which has attacke the mature plants is steadily destroying them.

The enforced deferment of the Service's ruins stabilization work durin the war offered a serious threat to the Nation's heritage of antiquities i the Southwest. As a result, the ancient Tumacacori Mission in Arizon has begun to show alarming signs of structural failure. Prehistoric clif dwellings, pueblos and other pre-Columbian Indian structures require immediate attention by skilled stabilizers. Fortunately there are excellent prospects that emergency work can soon be undertaken with funds for rehabilitation and repair approved in the 1947 appropriation.

The difficulty, or the impossibility, of maintaining historic scenes against undesirable encroachments, where Federal land ownership is seriously inlequate, is well exemplified at Fredericksburg Battlefield, where so much the area consists of drives which traverse narrow strips of park land.

Logging operations now in progress along Lee Drive will denude of mber all private property along the drive. The development of suburban ubdivisions near the drive, at the base of Lee Hill, and adjoining park nds on the Chancellorsville battlefield, will inevitably detract from the istoric interest of those portions of the park. Similar encroachments by evelopments not consonant with the historic scene are in progress on the orders of both Gettysburg and Vicksburg National Military Parks.

Although National Park System areas are involved only in a few instances, the Service and the Department have a legitimate concern over he possible effects of river basin developments, including the construction f huge dams and the impounding of great bodies of water, upon historic nd prehistoric sites in the areas inundated. These threaten the loss of riceless materials unless the impoundments can be preceded by thorough econnaissance and by the careful removal of the materials so revealed. ighty percent of the major archeological sites of the country lie in river alleys; the Missouri and its main tributaries are considered by anthropologists to possess extraordinary importance in the study of early man on the North American continent.

A cooperative agreement between the National Park Service and the Smithsonian Institution placed upon the latter the responsibility for excavation of selected sites and thus the saving of further scientific evidence rom permanent loss; and the allotment of funds from the Bureau of Reclamation and the Corps of Engineers has permitted a start on this work. Three field parties in June were assigned by the Smithsonian Institution o make reconnaissance surveys in the Missouri Valley, and arrangement or a start on studies in other river basins was being made. Such surveys will be useless, however, unless they can be followed by a large-scale excavation program in each major dam construction area.

An important step in foreseeing preventable damage by reclamation works was taken this spring, when Secretary Krug approved a memorandum of agreement between the National Park Service and the Bureau of Reclamation which provides for full consultation by the Bureau with the Service in advance of the detailed planning of any reclamation projects which would in any way affect the areas within the National Park System.

To the request of the War Department for the permanent use of lands on the Chickamauga Battlefield, for which temporary use had been granted during the war, Secretary Krug returned a vigorous denial.

"Each of the military parks is the last possible debt payment of the Nation to a portion of our soldier dead," he asserted, "and I should be unwilling to agree to the permanent dismemberment of any of these areas except in case of dire national need."

Secretary Krug continued efforts to effect a solution of the Virginia Peninsula traffic problem. The Virginia Highway Department, as well as individuals and organizations in the Hampton Roads region, advocate the construction between Yorktown and Gloucester Point of a high-level suspension bridge which will permit the passage of naval vessels of any class. The Service and the Department have opposed this proposal for several years, and with the cooperation of the Public Roads Administration, have endeavored to obtain favorable consideration of a crossing higher up the river. The massive suspension bridge, if constructed, would tower higher than the Yorktown Victory Monument and would overshadow the battlefield on which American independence was finally and conclusively won and the village in which the Federal Government has striven, at considerable expense, to retain a colonial atmosphere.

Of the effects of human use—complicated by that of animals, in this case—Superintendent White of Sequoia-Kings Canyon National Parks has this to say:

> Nature will not restore the over-used areas where men trample and deer and rodents eat all natural growth. Either we replant or we fail at our job of conservation in these parks. To replant we must have a nursery and the personnel to run it * * * We should frankly face the need of setting aside more and larger areas for public use. This is also necessary so that we can rotate the use of campgrounds and other over-used places.

Protection against forest fires effective.—The fire suppression record of the National Park Service continues to be one in which the Department takes pride. More than 9,500,000 acres of forest, woodland and grassland require intensive protection. Yet only 40 out of a total of 335 forest and grass fires in 1945 were allowed to exceed 10 acres in extent. The total burned area was only 4,991 acres, slightly more than half of 1 percent of the area protected. Although the slim organization of fire-control personnel was necessarily composed largely of teen-agers, continuing training and drill made this record possible.

The value of "smoke-jumpers" in suppressing forest fires in remote areas was conclusively demonstrated in Glacier National Park, where crews were parachuted to and suppressed seven potentially dangerous fires, at a time when all available ground forces were engaged on other more accessible blazes. Provision has been made for expansion of this service, which involves close cooperation with the Forest Service in training and utilization.

During 1945, employment of a Civilian Public Service crew at Mount Rainier National Park made possible a start on reducing the serious fire hazard which was created by the presence of countless snags left by former fires. Funds are available for carrying the program forward into the next season.

Prison sentences of 5 years each, meted out to two men convicted of wilfully starting forest fires in Great Smoky Mountains National Park, seem to have had a deterrent effect, as no further incendiary fires have been reported from the park. The convictions resulted from FBI cooperation.

The use of an orthodichlorobenzene and oil penetrating spray on an epidemic attack of Engelman spruce beetle, which threatened to wipe out the forest fringe around Cedar Breaks National Monument, and on a less extensive mountain pine beetle attack in Rocky Mountain National Park was successful in both cases. Though control measures for outbreaks of the beetle in Grand Teton National Park are under way, the epidemic spread of attacks outside the park, if unchecked, may nullify the effective work of previous years. In Great Smoky Mountains National Park, experimental use of penetrating sprays to combat the southern pine beetle have been successful, and plans have been laid to combat several outbreaks of this insect. There has been effective maintenance control of endemic bark beetle attacks in Mount Rainier and Yosemite. Periodic control work over the years has lessened the over-all damage caused by insects and, in general, park forests are in excellent condition.

White pine blister rust, now entrenched in the northeast and northwest and spreading southward, is the most serious tree disease threatening park and monument forests. The control program, though slowed by the war, continues to progress. Of 450,136 acres in the Service's control program, 241,100 acres have been worked over at least once and 163,071 acres are considered to be on a maintenance basis.

Periodic spraying of the beech in Acadia National Park for control of the European beech scale has proved effective in preventing the inroads of the beech bark disease, which threatens to wipe out much of the beech in the northeast. The control system has been systematized and it is hoped by this means to preserve for posterity a sample of the widespread beech stands which elsewhere seem threatened with extinction.

System areas are sanctuaries for wildlife.—The national parks and monuments are sanctuaries for more than 65,000 hoofed animals and for unestimated thousands of carnivores or flesh-eaters. A list of the bird species undoubtedly would include most of those known to inhabit the United States and its territorial possessions. There are vast numbers of less conspicuous creatures.

Settlement of the American continent has wrought far-reaching changes in the homes of most species. For those mammals and birds which are unable to adjust themselves to close proximity of man or to man-caused changes of environment, the wilderness areas of the national parks and larger national monuments have been all-important to survival. This is true of such species as the grizzly bear, the wolf, the fisher, and the trumpeter swan. Other species, which definitely are endangered and for which various units of the National Park System serve as important retreats, are bighorn, marten, otter, kit fox, cougar, and lynx. The list will be further enlarged, whenever the Everglades National Park is established, to include the Everglades and swallow-tailed kites, Florida crane, roseate spoonbill, the manate and the American crocodile. Some of the species named above would prol ably have become extinct if it were not for the type of protection afforde by national parks.

Basic management policies.—The animal life of the parks serves its higl est purpose as a living representation of the original American fauna. I stead of serving as food, fur, or trophies for a few, the wildlife is "utilized without being consumed, by millions of Americans who come to the parl to observe, photograph, and study. Predators are protected together wit their prey, as a part of a balanced wildlife community. This exhibit of th entire fauna in natural surroundings affords science an unparalleled o portunity for research and the public a unique field for observation an enjoyment.

One of the greatest contributions of national parks to wildlife conserva tion may be demonstrated in the coming air age, which will render mos of the remaining roadless areas accessible by planes, and will bring ther within easy travel range of many more millions of people, including hunter Legally, the parks remain the only inviolable areas where wilderness sanc tuaries stand a chance of being held.

Future offers management problems.—The purpose of wildlife manage ment in the National Park System is to preserve the fauna "unimpaired (act of August 25, 1916, establishing the National Park Service). Insofa as possible, artificialities are kept at a minimum and natural forces ar allowed full play. Resort to management is necessary at times, however even in the largest and least developed of the national parks. Only a fev parks or monuments are truly self-sufficient biotic units, and outside in fluences as well as the effects of man's occupancy of the parks themselve sometimes require compensatory action.

Population pressures of hoofed animals in a number of the units of th National Park System continue to present problems of wildlife managemen of varying degrees of seriousness. The elk problem in the northern Yellow stone has existed for at least half a century. When legal hunting nortl of the park and live shipments from within it failed to hold this herd t the carrying capacity of the range, a considerable number of these animal had to be slaughtered, and the herd was thus reduced to a size (approxi mately 7,000) for which the range was reasonably adequate. Since tha time, hunting in the region to which the elk migrate north of the park has been fairly successful in preventing a material increase. About 2,20 elk were removed by the 1945–46 kill, by hunters outside the park, and a reduction of 2,800 should be made in 1946–47. Some species of forage are improving, but others are making little, if any, progress. Aspen is being extirpated steadily.

Deer reductions at Zion.—Overuse of vegetation by mule deer in Zion Canyon, Zion National Park, since about 1930 had caused marked changes in the aspect of this area. The deer population, therefore, was greatly duced by slaughter beginning in 1943. The number of animals will be aintained at a low level for several years to come to permit full recovery the food plants. On the east rim of Zion Canyon, where an extremely eavy deer population undoubtedly is having a bad effect on the few maining bighorns, 112 deer were killed in 1945. Many more should e removed to better the bighorns' chance for survival.

A "surplus" of moose existed on Isle Royale, Mich., for more than decade before inclusion of the island in the national park system. A ense beaver population also occurs on Isle Royale which, by competition or food, intensifies the plight of the moose.

A problem of many years standing in a small scenic portion of Rocky Mountain National Park appears to have been relieved during the winter f 1944–45 by the destruction of 113 deer and 301 elk. The vegetation reported to be recovering and the remaining deer and elk are well within he carrying capacity of the range.

It is believed in some quarters that establishment of the Jackson Hole National Monument may make it difficult or impossible to control the size f the portion of the southern Yellowstone elk herd that winters on the National Elk Refuge. A portion of the monument area (Antelope Flat) has been open to hunting, and has been the scene of occasional slaughters, but under National Park Service administration would be closed to hunting. A study is being made of the migratory routes and habits of the elk in order to determine the probable effect of prohibiting hunting on Antelope Flat. The Service is cooperating with the Fish and Wildlife Service and the State authorities with the aim of simplifying, rather than making more complex, this already complicated problem.

Mount McKinley wolf reduction.—The Dall sheep population of Mount McKinley National Park has undergone marked reduction during the past decade and is now believed to number about 500 animals. Assertions that wolves are responsible for the reduction have been numerous, though studies made by Dr. Adolph Murie, of the Fish and Wildlife Service, in 1939, 1940, 1941, and again in the fall of 1945 failed to produce conclusive evidence that these assertions were correct. However, as a means of providing possible aid to the comeback of the Dall sheep, the killing of 15 wolves was authorized early in the winter. Immediate efforts to reduce the wolf population were not successful, but a part of the authorized kill was effected during the late spring and early summer of this year. The Service will take whatever steps further investigation shows to be necessary to a proper balance between wolves and sheep.

Restoration of extirpated species.—Restoration of an animal which has been exterminated from a park is desirable in order that that species may again be represented to the public, and because the primitive relationships between species should be restored. If the extirpated species is present nearby, any natural tendency to move back to the park is encouraged. Otherwise, restocking becomes necessary.

Following this principle, the bighorn was restored to Mesa Verde National Park in January 1946 after an absence of a half century, with 14 animals supplied by the Colorado Game and Fish Commission. A number of other projects of like nature should be undertaken.

As a result of a better understanding of aquatic ecology, emphasis has been given in recent years to more natural management of the park fishery. Natural spawning is being relied upon more than formerly to supply fish, though necessarily, artificial culture and restocking must continue to play a part.

Progress has been made by the Fish and Wildlife Service on studies to provide the information which is absolutely necessary for proper fishery management. The bulk of the work has been done in Yellowstone, Glacier and Great Smoky Mountains National Parks. Research needs to be carried to completion in these parks and extended to a considerable number of other areas where fishery management problems are important and pressing.

Landing Fields in Parks Generally Unnecessary

The annual report for the fiscal year 1944 announced the Service's policy strongly upheld by the Department, of opposing the establishment of airplane landing facilities within the parks. The policy then announced and repeated again last year, still stands, though expressions of disagreement with it continue to be voiced by some who feel that the airplane should be accorded equal rights in the parks with the automobile.

The position of the Service is not based upon any prejudice against the airplane as a mode of transportation. It is obvious that increasing air travel to the parks is inevitable. The facts are, however, that the reasonable desires of the airplane advocates can be met quite as satisfactorily without invasion of the parks as would be possible if landing fields and servicing facilities were provided within them. Sightseeing over the parks reasonably regulated and held to a proper altitude, may well be considered desirable at many places, but can be enjoyed as well from ports situated outside as from those which might be developed inside park boundaries.

Whatever the point at which a plane comes to earth, it then becomes necessary to utilize some other form of transportation to get the visitor and his baggage to such overnight or daytime accommodations as he may seek or to take him to the various points of interest in the park which he may wish to see. Such supplementary transportation can be supplied satisfactorily from an airport such as, for instance, that which now serves the south portion of Grand Canyon National Park or that at West Yellowstone. This is the same principle that now governs rail travel to the parks.

Visitors seek quiet.—Considering then that the lack of landing facilities in a park needs to be no handicap to either the private owner wanting to fly to it or to the commercial airline which wishes to bring visitors there by air, the disadvantages that would result from providing landing and ervicing installations in these areas fully justify the policy that has been dopted. The degree to which the low flying of take-offs and landings would rove a disturbance to park wildlife is problematical; for some rare species, uch as the trumpeter swan and the sandhill crane, it would probably be erious. There is also the possibility of increased fire danger and of damage o natural features. The provision of safe facilities obviously would involve major disturbance of and extensive changes in the landscape in most f the parks. Excessive noise also would be a disturbing factor out of keepng with the atmosphere of quiet, a primary objective of most visitors to the arks. That objective would be denied if landing facilities were provided n the parks themselves.

In view of these facts, the policy to which the National Park Service s adhering seems to be abundantly justified. As a corollary of it, the Service s endeavoring to formulate and obtain approval of a regulation that would restrict flights over the parks to altitudes that would minimize disturbance and danger and assure keeping the present environment unspoiled.

Continuing study and observation, together with experience elsewhere, will throw more light on this question. Meanwhile, the Service feels that it should take a conservative position.

Increased Public Safety Sought

Considering the rugged wilderness character of many of the national parks and monuments, and the inexperience of a large proportion of visitors in such surroundings, it is to be expected that among the many million who visit them each year there will be some serious and occasional fatal accidents. No methods can be devised to prevent these entirely, but the National Park Service recognizes that the protection of visitors is a serious and sobering responsibility, and the effort to assure adequate protection is constant.

The recent tragic accident in Yosemite National Park, in which a small boy and the heroic young man who attempted to rescue him were swept to death over Vernal Falls, indicated that the protective rail at that point was inadequate to prevent children from approaching the stream above the falls; and remedial measures are being taken to prevent a recurrence of such accidents, there and at other similar places. However, the great majority of accidents result from failure to heed regulations designed for the safety of the visitor or advice that is based upon long, and often bitter, experience. All too many of them have happened to individuals who have insisted on striking out into the wilderness or undertaking hazardous climbs by themselves.

Only extraordinary good fortune brought a happy ending for the university student who wandered from his companions at the Badger Pass ski area in Yosemite National Park last winter and was lost for 11 days. In this instance, all three of the Service's repeatedly emphasized warnings to skiers—that they should stay in groups, should stay on marked trail and should carry matches (for both warmth and signaling should the become lost)—were disregarded.

Regulations just common sense.—It is difficult to get visitors to the park to realize that park regulations are designed to further their safety, rathe than to impose irksome restrictions on their freedom of action, though is probable that more thought and effort need to be expended in educatin visitors not only as to what the regulations are but as to the reasons tha make them necessary. Probably nothing better exemplifies this difficult than the regulations which forbid the feeding of wild animals. It hardl seems possible for anyone who can read to visit Yellowstone or Yosemit National Parks without being aware of the prohibition against feeding th bears. Yet year after year, hundreds of visitors insist on taking chance by handing these genuinely wild animals tidbits of food, and every yea has its record of serious and even occasional fatal injuries to those wh indulge in the practice. The Service is constantly searching for new methods of impressing upon the public the hazards of familiarity wit park wildlife, as well as the injurious effects upon the wildlife itself o unsuitable diet and of dependence upon "panhandling" for food.

The Colorado River, where it runs through Grand Canyon Nationa Park and the Boulder Dam Recreational Area, as well as its upstream reaches, has extended an invitation to the adventurous ever since Majo Powell and his party made the descent in 1869. Repeatedly, however attempts to descend the river have compelled difficult and dangerou searches of the treacherous stream. Renewed consideration is being give to recommending a regulation which would forbid any person running th rapids in Grand Canyon National Park or Boulder Dam Recreational Area except after a showing that they are properly qualified to do so.

The National Park Service has a safety engineer whose entire time devoted to the promotion of safety and safe practices. His concern with the public and with the reduction of unnecessary and avoidable risk to the visitor as well as to the employees of the Service and the concessioners, and to property as well as persons. Every effort will be made t effect prompt improvement of any conditions of hazard which his studie or those of others may reveal.

Service Ill-Equipped for Information Work

The information activities of the National Park Service belong in tw main categories, (1) general information, supplied through the publications issued by the Service, through newspapers, magazines, radio, an motion pictures, as well as through correspondence; and (2) interpretation, supplied usually direct to the visitor by ranger naturalists, range historians, museum displays, exhibits in place, and special publications In both of these categories, the Service was compelled to function throughout the year with little more than the meager staffs of war time. Fund or 1947 are nowhere near sufficient to afford information or interpretive ervices that park visitors or the public as a whole are entitled to receive.

Nature and history need interpretation.—With the cessation of hostilies and the resumption of recreational travel came an immediate demand rom park visitors for the full restoration of the history and natural history nterpretive programs. This demand could not be satisfactorily met during he summer months of 1946. Supplemental funds made available on anuary 1, 1946, enabled the Service to reemploy 19 of the 32 permanent park naturalists who had served in the armed forces or engaged in civilian war work.

So far as possible lectures and guided trips, as well as museum services, were offered during the second half of the fiscal year. Museums, many f which had been closed for the duration, were renovated and made ready or opening; the production of "Nature Notes" was resumed in some of he parks and, generally, the interpretive organizations returned to "business as usual." However, returning employees and those who remained t their posts have been handicapped by the lack of funds for the employment of seasonal ranger-naturalists. In the historical areas demands for nterpretive services in many cases preceded the return of staff historians rom the armed forces. By the year's end, many historians who had used heir specialized training during their service with the Army or Navy, had returned to their former positions. Every effort was made to provide the utmost in service with a limited personnel.

Cooperating museum, library, and natural history associations in several parks and monuments have taken an active part in the park naturalist programs and have rendered particularly effective assistance in selling publications.

Oregon's Advisory Board on Educational Problems of Parks proposed he establishment at Crater Lake National Park of a field school of art and nature appreciation, to be a cooperative effort of the National Park Service and the extension division of the State system of higher education. The proposals submitted by officials of the University of Oregon have received consideration in conferences in the Director's Office and in Eugene, Oreg., and are still being worked upon.

Museum Division activities.—Only one permanent National Park Service exhibit was prepared and installed by Service employees during the year. This is a diorama showing the appearance of the interior of Ford's Theater on the night Abraham Lincoln was assassinated. It is exhibited in the Lincoln Museum, Ford's Theater, Washington, D. C.

Exhibit planning was continued in connection with the project construction program of physical improvements. A special study of the interpretive needs of Great Smoky Mountains National Park resulted in the completion and approval of a museum prospectus as a basis for future planning and development. Museum prospectuses were also completed for Mount Rainier, Glacier, and Zion National Parks.

Special protective and operational studies were made at the Home of Franklin D. Roosevelt previous to its opening to the public as a National Historic Site. Special museum assignments were a study of methods to be employed in an inventory of historic furnishings of the White House and completion of studies for the exhibits in the proposed William H. Jackson memorial room, Scotts Bluff National Monument.

Opportunities to inform public too limited.—During the war, the staff of the Office of Information was reduced to 10 percent of its prewar size and funds for printing of all kinds were very meager. The small staff and limited funds made possible only a bare start, before the end of the fiscal year, on the work of revising and issuing the free information literature required to meet the needs of both actual and prospective visitors, and which had been held almost completely in abeyance during the war. Publications scheduled are being limited to those required for satisfactory field operations and for meeting requests, numbering thousands daily, received by the Director's Office in Chicago, the Washington Liaison Office and the field offices of the Service.

Demands for literature grow.—Requests upon the Director's Office for printed information about the parks increased 115 percent. A much greater volume of requests go direct to the individual areas. The demands will grow as the public learns that booklets are again available. The approximately 100 percent increase in park travel indicates a similar increase in the need of free publications for distribution in the parks.

In consequence of the limited funds available, sharply reduced from the amount recommended by the Bureau of the Budget and still further reduced, in effect, by rising costs during the past few months, the production of sales publications, useful and necessary as they are, will be virtually at a standstill during the coming year.

Manuscripts go unpublished.—Manuscripts of a number of publications, which already represent a considerable investment of public funds in research and writing, must be pigeonholed for the present. This represents a loss to the public. It also is decidedly discouraging to those who have performed the laborious task of preparation. Nor does it encourage others to embark on similar undertakings when there are only slight prospects of publication. Yet these writings, which tell of the meaning of the parks, are an important phase of the Service's work.

Because of staff limitations, the Service is unable more than barely to touch certain important channels of public information, such as radio, motion pictures, illustrated lectures, and photographs. The Department's facilities for radio recording were utilized only twice during the year. A transcribed interview with the Director, to inform the public as to the condition of the parks after 4 years of war and as to the efforts of the field forces to meet the needs of visitors was put on the air by an estimated 130 stations throughout the country. In advance of the dedication of

Olympic National Park, radio coverage of the event in the Pacific Northwest was materially assisted by transcriptions of the Secretary's important dedication address, which were supplied to a number of stations in that region.

To the Service's modest library of motion picture films one picture has been added during the year. Covering Grand Teton National Park and Jackson Hole National Monument, it is composed almost wholly of footage taken by John C. Hanson of Washington, D. C., and William L. Darden of Evanston, Ill., both highly proficient photographers who gladly contributed the results of their work. The Service could readily utilize a considerable number of such films, but lacks the facilities or staff to make effective use of the few good reels it possesses or of its extensive but increasingly obsolescent collection of kodaslides.

Photographic program needed.—With the resumption of peacetime travel, the demands from magazines and newspapers for park materials, both written and photographic, have been extraordinarily heavy. The Service had hoped to be able to employ one photographer during 1947, but the funds appropriated for new positions are not sufficient to permit it. Outside demands and the requirements of the publications program justify a moderate, well-planned program for the making and distribution of photographs, so that the Service may have on hand striking current pictures, not "dated" by automobiles of ancient vintage or by evanescent feminine fashions. The subject matter of the park system deserves to be adequately pictured to the public.

Whole public should enjoy parks.—A comparatively small percentage of Americans can spend the time and funds to become well acquainted with the National Park System at first hand. A good many see few if any of the parks or monuments during a lifetime. The greater number of those who are able to visit any of them see only a small percentage of the whole. The task of the National Park Service, usually conceived to be that of providing enjoyment to those who pass through the park gates, should extend far beyond that. The motion picture, with its effective employment of color, the colored stereopticon slide, good photographs and well-illustrated publications all are capable, in a sense, of bringing the parks to the people, thereby heightening their sense of pride in what they possess and providing a high degree of enjoyment.

It is a part of the business of the National Park Service to encourage and assist the considerable number of persons who make and show good motion pictures of the parks, either as a hobby or professionally. Yet the showing of these reaches only a fraction of the potential audience. The schools, and organizations such as Parent-Teacher Associations that are closely associated with the schools, offer a mass audience which now is reached scarcely at all. Yet every school child should know about the parks—what they are and why they are—and something about how they are managed and enjoyed. Every school should have on its walls striking pictures of the great places of America, and good books which, by picture and text, will provide knowledge and understanding of them. We believe that it should be possible to provide motion pictures of professional quality at low cost so that school groups and parents alike may derive enjoyment and satisfaction from possessions that many of them may never see in any other manner. The same is true of universities. Making this possible seems to be a legitimate field in which to expend Government funds, without neglecting any opportunity to obtain nongovernmental cooperation in its accomplishment.

Enlightened public needed.—The successful functioning of the National Park System is dependent, to an important degree, on an informed and understanding public. They are the owners of the parks. It is important to widen the circle of the adequately informed who are at the same time sufficiently concerned to take an active interest in supporting and defending sound and foresighted management of natural and historical resources. We consider it necessary and justifiable as a means of holding the successive gains in protecting and making the parks available to the people which congressional action has made possible.

The Advisory Board

The death of Dr. Thomas Barbour on January 8, 1946, was a blow to the Advisory Board on National Parks, Historic Sites, Buildings and Monuments, of which he had been a member since 1941, and to the National Park Service. His place on the board was filled by the appointment of Dr. Harold E. Anthony, dean of the Scientific Staff, American Museum of Natural History. Dr. Theodore C. Blegen, dean of the University of Minnesota Graduate School, was appointed to the vacancy caused by the death of Mr. Edmund H. Abrahams, recorded in the last annual report.

The Board's interim committee met in Washington on December 11 and 12, 1945, to consider post-war problems facing the Service. Acting through Dr. Waldo G. Leland, acting chairman of the Board, the American Council of Learned Societies sponsored a highly profitable meeting of historians at Jamestown, Williamsburg, and Yorktown on May 6 and 7, for discussion of problems relating to the utilization of historic objects and physical remains in research in American history.

Development Planning a Complicated Task

The determination and planning of desirable and essential development programs is one of the major tasks of the National Park Service. It must decide what is needed or likely to be needed, both to provide adequate service and facilities to the visitor and to facilitate administration; what sites are suitable and what kinds of structures will be appropriate and inconspicuous so that their presence will impair as little as possible the scenic, historic and scientific features which it is obligated to conserve.

The unprecedented number of visitors during the past travel season, the 5-year lag in providing additional physical improvements, and the increase of public interest in cold-weather activities which may compel the operation of several additional parks during the winter on a considerably larger scale have shown the need of reexamining existing construction plans and policies. This has been undertaken as extensively as reduced wartime staffs would permit, during the past several years.

Past studies have indicated the advisability of gradual removal of administration and concession facilities, in several of the national parks, from their present sites to new areas; of invoking again the limited-stay policies in campgrounds and concession facilities at the height of the season in such areas as Yosemite Valley; and of considering the possibility of Government construction of facilities in areas where private capital cannot be induced to provide suitable hotels, lodges, meal services and winter sports facilities. While the Service is minimizing the possible future Federal outlay for such facilities, as well as the impact of intensive use, by encouraging the provision of overnight facilities where they can be provided satisfactorily outside, some such developments must, in most cases, be located within park boundaries. The general aim is to avoid concentrations such as that which began nearly a century ago in Yosemite Valley, and to distribute the visitor load more evenly.

The immediate program.—The accumulated building demands of the nation for residential, commercial and industrial purposes are certain to make it difficult in the next few years for Government bureaus to compete in a high-priced, scarce market for skilled building workers, materials and mechanical equipment; and the obligation rests upon this and all other Federal agencies to avoid such competition as much as possible. The best course immediately open to the Service, therefore, appears to be to proceed with major repairs and rehabilitation of existing physical improvements whose usefulness can thus be extended until new facilities can be constructed; to undertake the surfacing, bridge construction and other work that will enable the public to use the roads, trails and parkway projects or parts of projects which are now only partially completed; and to install or repair the essential sewer, water, electrical and communications systems. A coordinate task is the obliteration or, where desirable use can be made of them, the repair of the roads, buildings, warning stations, pipelines and other facilities installed in various units of the park system by military or other war agencies to facilitate the conduct of the war.

The Interior Department Appropriation Act for the 1947 fiscal year makes the following provisions for developments of various kinds:

Parkways (Blue Ridge, Natchez Trace, George Washington, and Foothills), for both construction and maintenance	$11, 000, 000
Roads and trails, including major and minor road and trail construction, advance plans and surveys, and approximately $2,000,000 for maintenance	6, 000, 000
Physical improvements, of which $1,000,000 is required for repair and rehabilitation of existing structures	1, 330, 000

Several areas still undeveloped.—Beginning with 1948 fiscal year, much larger appropriations will be needed if the signs of war use are to be obliterated, the lag in normal construction and maintenance made up, and the development of several major areas provided for. Big Bend National Park and Glacier Bay National Monument, for example, now contain practically none of the roads or other improvements which are essential to public use and enjoyment; Olympic National Park and Great Smoky Mountains National Park are in hardly better development. A number of areas are seriously in need of housing for employees, especially those who are now compelled to occupy houses almost medieval in their lack of conveniences.

Alaska areas require development.—Early development of Glacier Bay National Monument, Alaska, is of interest to the Department of Commerce, the Government of the Territory, and the Department of the Interior, because of the development during the war of a large airport at Gustavus Point, in the monument. Now operated by the Civil Aeronautics Authority, it will be the main airport for large commercial planes from the States, where passengers will transship to smaller planes for various Alaska points, or will continue on the large planes to the Orient. Facilities for the feeding and housing of, possibly, several hundred plane passengers grounded by unfavorable weather for 2 or 3 days do not exist. This factor, combined with the nearness of Juneau, the capital of Alaska, points to early and heavy visitation by both steamship and plane passengers and to the need of accommodations which would serve both groups.

At Mount McKinley National Park, the National Park Service is assisting the Alaska Railroad in developing architectural and general lay-out plans for enlargement of the hotel at McKinley Park Station, and for a lodge at Wonder Lake, situated 80 miles inside the park.

The general interest of the administration in improving the economy and encouraging settlement and development of Alaska places an obligation on the Service to make early plans for the development and administration of the five park system areas situated within the territory. Considerable progress on this task has been made during the past year.

Volume of Cooperative Work Grows

Cooperation by the National Park Service with other Federal agencies and with the States in recreational land planning studies continues to increase in volume, and is rapidly becoming a major responsibility, the extent of which is not generally realized. During 1946, for the first time, a direct appropriation was available to implement the Park, Parkway and Recreation Area Study Act of 1936. This enabled the Service to reestablish, on a modest scale, a staff of technicians whose services were provided to the States on request, to help solve State park problems.

In addition, related work performed for the Bureau of Reclamation and the Corps of Engineers was greatly enlarged. Funds allocated to the

Service by these two agencies have financed investigations of the recreational possibilities of water control projects, and assistance in planning for the protection, development and use of such resources in several major river basins and on hundreds of individual reservoir projects.

Cooperation with Federal agencies.—The National Park Service is but one of a number of Federal conservation agencies which have been called upon to appraise the potentialities, both favorable and unfavorable, of the many impoundment projects which the Bureau of Reclamation of the Department of the Interior, and the Corps of Engineers are planning or have under construction. The Service's part of this work is to determine, with respect to each of these projects, not only whether it has possibilities for recreation but also to aid in determining whether provision for it would be justified, economically and socially. It is additionally concerned with the integrity of the various units of the National Park System that may be adversely affected by such projects. In defending park areas against damage by dam-building and water-control developments, it is the duty of the National Park Service to raise the question as to whether public necessity for irrigation or flood control or generation of power outweighs the potential damage to natural scenery or to significant natural or historic or prehistoric objects or places. Allied to these considerations is concern with the scientific, historic and prehistoric values of all lands which would be affected by water-development projects and with the salvage of cultural materials from lands which are to be flooded. In several cases, such as the Missouri Basin, the Service has been asked to undertake studies on these matters well in advance of construction.

The Missouri Basin—The survey of recreational potentialities in the Missouri River Basin, related to projects of both the Bureau of Reclamation and the Corps of Engineers, begun during 1945, has been continued and enlarged during the past year. Bureau funds of $10,000 made available for this study in 1945 were increased to $55,000 in 1946, of which $20,000 was put at the disposal of the Smithsonian Institution for the conduct of archeological and paleontological investigations of extraordinary importance in this particular basin.

During the past year, the field survey staff of the Service completed preliminary investigations of 11 reservoir sites for the Bureau of Reclamation and 4 for the Corps of Engineers. An expanded program for continuance of the survey has been proposed for 1947.

In other basins.—Studies similar to those in the Missouri Basin were also continued with increased impetus, in connection with other existing and proposed Bureau of Reclamation projects, by the National Park Service and Smithsonian. Following is a brief summary of these:

1. In the Colorado River Basin, preliminary recreational investigations of approximately 120 reservoir sites have been completed, and a comprehensive report has been drafted. Since the survey was started in 1941, $93,000 has been allotted for it and for publication of the report.

2. Under cooperative agreements beginning 1941, $19,500 has been advanced for investigations of 138 reservoir sites under consideration by region 5 of the Bureau of Reclamation on 7 river basins in Texas, Oklahoma, and parts of Kansas, Colorado, and New Mexico. An agreement for continuance of this work is being negotiated.

3. Under an agreement approved on May 27, 1946, the Service has undertaken the investigation of 16 reservoir sites in the Pacific Northwest, of which 13 are located in the Columbia Basin. To start this work, $40,000 has been advanced and a staff is in the process of organization.

4. An investigation of four of the Bureau's Central Valley project sites in California is being conducted pursuant to a pending agreement which provides $15,000 for the work. It is probable that the Service will be called upon to investigate numerous other projects here, both Bureau of Reclamation and Corps of Engineers.

Corps of Engineers projects.—At the request of the Chief of Engineers, made in accordance with section 4 of the Flood Control Act of 1944, the Service has continued to make preliminary investigations of water control projects under War Department jurisdiction, and to prepare recommendations for their protection and use of their recreational resources. With a fund of $88,700 advanced by the Corps of Engineers, 68 sites were investigated during the year.

Alaska Highways Report.—The report, entitled "Recreation Resources of the Alaska Highway and Other Roads in Alaska," based upon a survey conducted during 1943–44 by the Service at the instance of the late President Roosevelt, was released by the Government Printing Office in February. Prepared with Alaska Highway funds of the War Department, the report considers the protection of scenic, scientific and historical features of lands adjacent to the highways of Alaska and provides a broad base for establishing facilities for highway travelers in the Territory.

Cooperation with the States.—The sum of $68,000 was made available to the Service in the 1946 appropriation act for cooperation with the States in park and recreational planning. All State park agencies were advised that such cooperative assistance was again available, and 42 of them indicated their interest in obtaining it upon appropriate occasion. Forty-three requests for specific assistance have been received from 33 States, many of which have involved field consultations and investigations, covering a wide variety of problems. In addition, the Service has continued to serve as a clearing house for information on State parks and related types of areas. State Parks—1945, a pamphlet issued in June, contains tabulations of data furnished by the States on expenditures, sources of funds, attendance, personnel, and land acquisition for the fiscal year 1945.

New Area Added; Others in Prospect

On June 30, 1946, the National Park System consisted of 169 areas. One new national monument, Fort Frederica in Georgia, was established August 30, 1945. Built in 1736 by Gen. James Edward Oglethorpe, colonizer of Georgia, the fort was an English outpost against Spain. Credit for acquisition of the lands and resultant consummation of the project is due the Fort Frederica National Monument Association.

By act of March 22, 1946, Custer Battlefield National Cemetery was made a national monument.

Funds were appropriated by the Congress late in June for acquisition of the Montezuma Well property, an area of exceptional archeological and geological interest, as an addition to Montezuma Castle National Monument, Ariz.

The eastern half of Santa Rosa Island National Monument, Fla., was eliminated from the monument and reserved for the permanent use of the War Department, by Presidential proclamation of August 13, 1945. A bill to abolish the national monument and return the remaining lands to Escambia County, for public purposes, was pending in the Congress at the end of the year and has since become law.

Wind Cave National Park was enlarged by approximately 16,000 acres under the provisions of House bill 7004, referred to elsewhere. This will provide more and better range, with an increased water supply, for the bison and antelope herds which are an interesting feature of this park.

Bill would reduce Joshua Tree Monument.—A bill to revise the boundaries of Joshua Tree National Monument, Calif., pending in the Congress at the close of the fiscal year, would also provide an appropriation of Federal funds to purchase the checkerboard of non-Federal lands within monument boundaries. The measure is designed to reduce the area by approximately a third, leaving a total of some 558,560 acres within the proposed boundaries; to consolidate and retain the lands important for their rare desert flora, scenic and geologic interest; and to delete lands in which mineral values are believed to outweigh those for which they were originally included in the monument. The lands to be excluded are not essential for national monument purposes, since they have lost their original character. Their elimination will simplify administration and will release for mining lands better suited to that use. The discriminating support of this proposed legislation by conservation organizations and individuals is gratifying in view of the pressure of some local mining interests and sportsmen to open most or all of the monument to mining and hunting regardless of the national interest.

Touro Synagogue.—Oldest structure of its type in America, Touro Synagogue in Newport, R. I., was designated a national historic site on March 5, 1946. Designed by Peter Harrison, one of the foremost architects of the colonial period and erected in 1763, it is today in essentially its original condition. The structure will remain in non-Federal ownership and will continue to be used for worship.

Pending projects progress.—The famous Adams Mansion at Quincy, Mass., home of generations of the Adams family, is destined to become the

Nation's newest national historic site. At the year's end only formalities of title acceptance remained to be cleared.

No new national park or monument projects were authorized by Congress. Little progress was made on most of the 15 previously authorized projects due to varying circumstances. Lack of funds and personnel prevented determination by the National Park Service of specific area-requirements and boundaries in those cases requiring extensive study.

Everglades project moving.—The Everglades National Park project gained new impetus with the designation by the Secretary of a minimum area which, when it has been conveyed to the Government free of all reservations, will be acceptable for park establishment. This minimum area designation in no way prejudices attainment of the larger ultimate goal envisioned by those who conceived the project, which the Congress authorized in 1934. Last year the State of Florida conveyed to the United States, subject to certain temporary reservations, all of its holdings, aggregating over 1,000,000 acres, within the minimum area. When all the private holdings within the area so designated are acquired, protection will be insured the unique biological and other features of the area now threatened with impairment or destruction. Pending park establishment, the area already acquired is administered and protected by the Fish and Wildlife Service as the Everglades National Wildlife Refuge. The enthusiasm of the new Everglades National Park Commission recently reactivated and charged by the Governor of Florida with responsibility for acquiring the lands necessary for the park augurs well for the success of the project.

Cumberland Gap project.—Substantial progress has been made by Kentucky, Tennesseee, and Virginia in the acquisition of lands for the Cumberland Gap National Historical Park project. Of the 10,000 acres contemplated for this project, Tennessee has acquired virtually all of its portion; Virignia is acquiring its share as rapidly as possible. Kentucky holds title to approximately 85 percent of its quota and has appropriated $200,000 to acquire the remainder.

The Grandfather Mountain Association, a non-Federal body established to acquire lands for this proposed addition to the Blue Ridge Parkway, continues active, but no lands for the project have yet been conveyed to the Government.

Boundaries of the lands to be included in the Harper's Ferry National Monument were approved by the Secretary, in accordance with the provisions of the Act of June 30, 1944, and the committee on Harper's Ferry National Monument is furthering the acquisition of the 1,383 acres needed for the monument.

The Effigy Mounds National Monument project, for which the State of Iowa has acquired approximately 1,000 acres, lacks only conveyance of the lands to the Federal Government to complete the project.

At the end of the year, House bill 4435, to establish the Theodore Roosevelt National Park, was pending before Congress. It was later passed and sent to President Truman, who vetoed it on the ground that the area, part of the former Roosevelt Recreational Demonstration Area, did not measure up to national park standards.

Monument and committee authorized.—Also pending at the end of the year and later passed and approved were House bill 5125 to authorize the establishment of Castle Clinton National Monument on Manhattan Island, N. Y., and House bill 2851 authorizing the creation of a committee to conduct a study and make recommendations for the establishment of "a national shrines park" centering about the Independence Hall group in the old part of the city of Philadephia.

Boundaries and projects require study.—During the year, preliminary reports on the boundary status of the 169 areas in the National Park System were prepared in the field and submitted to the Director's Office for review and for determination of priorities for the detailed boundary studies which are to be undertaken. These reports reveal which of the areas now have satisfactory boundaries; which have definitely unsatisfactory ones; and which require further study before the question can be answered. The next step will be to determine whether and where lands are now included in the park system which should be excluded; also what lands, if any, outside of present authorized boundaries should be added. Work directed to this end has been virtually at a standstill during the war years. Material progress is confidently expected during the present year. Ultimate additions to or subtractions from any of the several groups of parks will, of course, require action by Congress.

Closely allied to this task is that of examination and appraisal of areas proposed for addition to the National Park System. Normally, 75 or more suggestions of this sort are received annually. Many proposed areas are patently unqualified and do not require field investigation. Others require careful investigation before any recommendations can be formulated. Those which possess merit, but which are not of national significance, are referred to appropriate state or local officials for consideration.

Since the investigation of proposed new areas virtually ceased throughout the war, there is now an accumulation of several hundred proposals to be studied. These are situated in all parts of the country, including Alaska and Puerto Rico. Thirteen field investigations of park and monument proposals were made during the past year. Of the approximately 50 areas proposed in that period, 17 were determined to lack proper qualifications.

The site of the first test-firing of the atomic bomb, near Alamogordo, N. M., was carefully examined and was reported on favorably with specific recommendations as to boundaries. It is expected that the area will shortly be established as the Atomic Bomb National Monument; and assurance has been given by the Secretary of War that the airplane which dropped the bomb on Nagasaki will be made available eventually for display there. For security reasons, however, the War Department's continuing custody of the bombing area in which the site is located will defer its opening to the public for some time.

States profit from RDA transfers.—Nine more recreational demonstration areas, containing 106,504 acres, were disposed of during the year, under the authority of the act of June 6, 1942 (56 Stat. 326). The 61,539-acre Roosevelt area in North Dakota was transferred to the Fish and Wildlife Service to become the Theodore Roosevelt National Wildlife Refuge. The other eight were deeded to the States in which they are located, as follows: Alexander H. Stephens, Hard Labor Creek and Pine Mountain, Ga.; Blue Knob, Hickory Run, Laurel Hill, and Raccoon Creek, Pa.; and Swift Creek, Va. At the end of the year, legislation introduced by Representative Hoch of Pennsylvania to return the greater part of the Hopewell Village National Historic Site to recreational demonstration area status was pending. It has since been passed.

Representative Case of South Dakota introduced a bill (H. R. 7004) near the end of the year designed to dispose of the 20,404-acre Custer area in the Black Hills. This bill, passed shortly before Congress adjourned and later approved by President Truman, provided for the addition of the greater part of the area to Wind Cave National Park and for transfer of the remainder, except for a small tract to be added to the Harney National Forest, to the State for addition to Custer State Park.

President Truman has indicated that the Catoctin area in Maryland, site of the retreat used by the late President Roosevelt during the war, and frequently referred to as "Shangri La," should be transferred to the National Capital Parks. It is planned to have legislation to accomplish this introduced in the next Congress.

Six additional areas of this group, containing 36,288 acres, in California, Kentucky, Missouri, and Oregon, are available for transfer. No decision has yet been reached regarding disposition of the Camden Hills area in Maine.

Recreational Areas Need Lands and Development

The assumption of administration of the recreational lands and facilities surrounding Lake Texoma, in Oklahoma and Texas, during the past year, under a temporary cooperative agreement with the Corps of Engineers, brought to four the number of areas for which such responsibilities have been accepted for other Federal agencies. Boulder Dam Recreational Area was the first of these; near the close of 1945, the Shasta Recreational Area, and the Millerton Lake Recreational Area, both in California, were added. An agreement similar to those which apply to the Boulder Dam, Shasta and Millerton areas is now being drafted for the Franklin D. Roosevelt Lake (Coulee Dam) area.

Effective use of all these areas is dependent on the provision of facilities for the public. A start had been made at Boulder Dam before the war. Negotiations are under way for a needed enlargement of concessioner facilities there. At Shasta and Millerton, a start has been made in determining what is needed, but no funds have been made available for more than minor developments.

Lake Texoma bristles with problems. A proposal early in the year that only two of a number of projected developments be turned over to the National Park Service, not only appeared undesirable to the Service but was strongly protested by the press, organizations and individuals in the surrounding territory, which favored following the plans for the area that had been formulated by the Service. However, though responsibility for the administration of recreation now rests with the Service, some 9,400 acres of additional land are needed. Adequate development for public use is virtually impossible so long as Federal ownership of lands bordering the lake is so seriously inadequate. Developments now under way on private lands will add greatly to the cost of ultimate acquisition.

The National Park Service did not seek this type of responsibility—the administration of recreation on lands and waters under primary jurisdiction of another agency—but it is trying to the best of its ability to carry out the mandate of Congress. No great success can be attained, however, if lands for recreational development are not acquired to meet the requirements of master plans.

Interest in parks increases in foreign countries.—Despite their countries' preoccupation with pressing postwar problems, visitors from every continent—from the Belgian Congo, Brazil, France, Great Britain, China, Denmark, Spain, Finland, the Netherlands, Sweden, Uruguay, India, Honduras—here on official missions either directly or indirectly connected with national park movements or park administration, visited and studied individual parks or the National Park System as a whole during the past 12 months.

Three French visitors made a wide swing to the parks and wildlife refuges in the West, for study of the management of such areas, with particular reference to the possible application of American practices to natural areas in the colonies. The Chinese forester who, during the past 10 years, has managed the Memorial Park of Sun Yat Sen, found his visit to a number of the parks and to Chicago and Washington offices of the Service helpful to the planning of park developments in China. The president of the Institute of National Parks in the Belgian Congo and a representative of England's Ministry of Town and Country Planning visited national park areas and found opportunity to discuss their problems with National Park Service personnel.

Requests for national park literature from many countries were numerous and were met as fully as possible.

War-use permit.—Since VJ-day most of the outstanding permits and authorizations for the use of National Park Service areas and facilities for war purposes have been terminated, and the areas are being returned as rapidly as possible to their former condition. There are still outstanding 68 permits for the use of National Capital Parks areas and 263 affecting other areas. A number of these are now in the process of termination; the War and Navy Departments are continuing to use certain areas on a temporary basis. One parcel of 3½ acres of land was transferred permanently from National Capital Parks to the War Department; seven parcels from other areas in the National Park System, containing a total of 9,600 acres, were transferred to the War and Navy Departments.

During the entire war period, 107 war-use permits were issued for occupancy of National Capital Parks lands, 2,204 for various uses of other National Park System areas. Of the latter group, 6 involved temporary transfer of jurisdiction; 80 were for utilization of minerals, timber, forage or water; 244 for occupancy and use of lands and facilities; 16 for exclusive use of concessioner facilities; 1058 for field exercises; 52 for rights-of-way; 32 for loan or transfer of material or equipment; 655 for hauling over parkways or park roads; and 61 for miscellaneous purposes. No major damage was caused to the National Park System by these war uses.

Dedications Mark Service's Thirtieth Anniversary

Nineteen forty-six brings the National Park Service to the thirtieth year of its existence, the act which established it having been signed by President Woodrow Wilson on August 25, 1916. Shortly thereafter, Stephen T. Mather was appointed its first director, and the fledgling Bureau took over administration of the 14 national parks and 21 national monuments that were then administered by the Department of the Interior.

The thirtieth anniversary of the Service has been variously noted in the press and over the radio. In a number of parks special exhibits have reviewed the history of the Bureau and the development of the National Park System. It has been especially marked by the dedications, already observed or to be observed, of four areas. Three of these, all national parks, have been members of the system for more than 5 years, while the fourth, the Home of Franklin D. Roosevelt National Historic Site, came into Federal possession during the past year.

An act of Congress approved in 1939 (53 Stat. 1062) authorized the head of any executive department to accept any part of the Hyde Park estate of President Roosevelt "for use in connection with any designated function of the Government administered in such department." It was pursuant to the terms of this act that the late President's home and 33 acres of land surrounding it became Federal property in November 21, 1945, and assumed full status as a national historic site. Left subject to lifetime rights

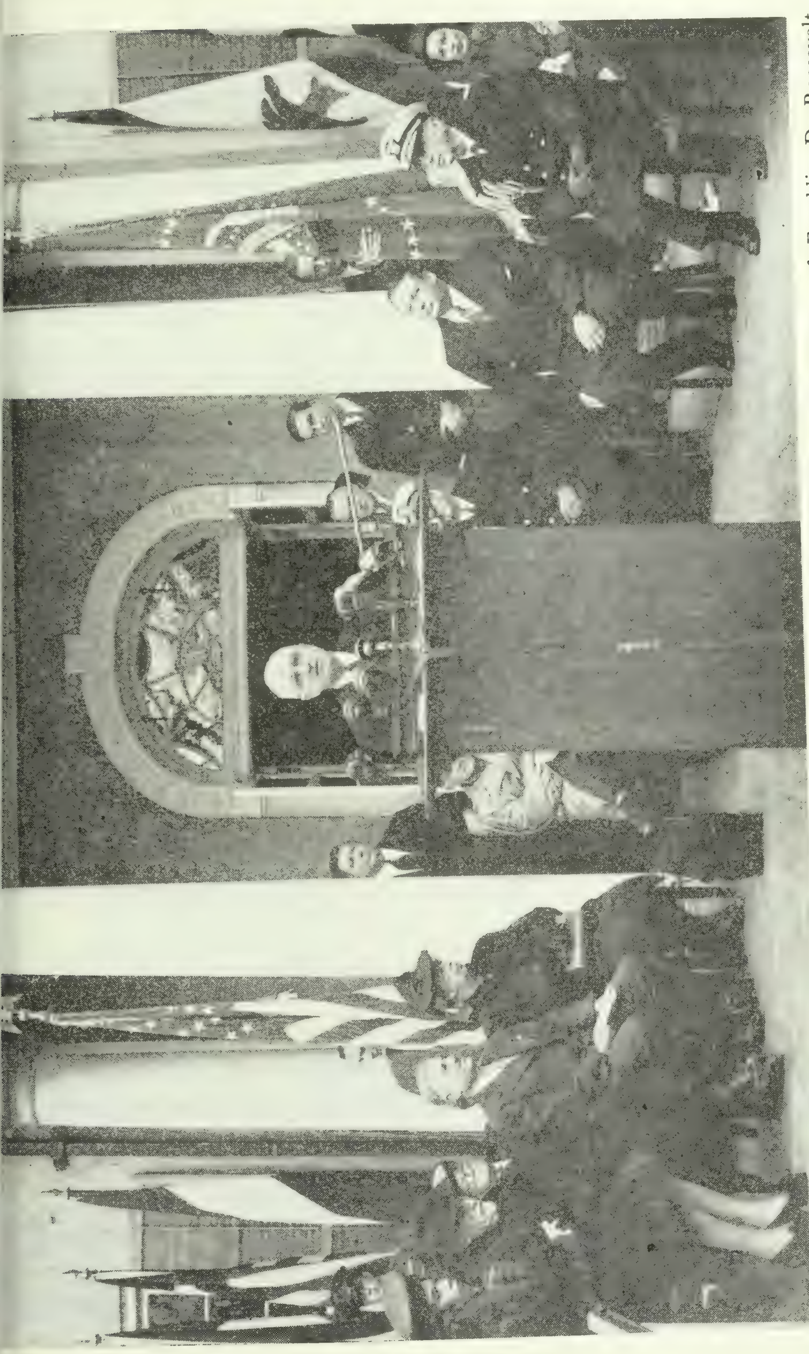

FIGURE 7.—President Truman delivered the dedication address from the front porch at the Home of Franklin D. Roosevelt National Historic Site on April 12, first anniversary of the late President's death.

of use and occupancy by the members of the immediate family, these rights had been surrendered by Mrs. Roosevelt and all the children in order that provision might be made for immediate public use.

The dedication, on April 12, exactly a year after the President's death, was held from the front porch of the interesting, beautifully situated home in which the former Chief Executive had been born and where he had lived most of the happiest years of his life. Some 10,000 persons were present. President Truman delivered a tribute to his predecessor; Mrs. Franklin D. Roosevelt made a brief address of presentation, and Secretary J. A. Krug formally accepted the estate in behalf of the United States. Miss Marian Anderson sang The Star Spangled Banner. Director Newton B. Drury of the National Park Service presided. In the audience were high-ranking representatives of the three major branches of the Federal Government as well as of State and local governments, and many of the diplomatic representatives of the United Nations. The radio coverage given the ceremony was one of the most extensive in history.

On the occasion of his first trip to the West after assuming his present office, Secretary Krug also participated in the dedication of Olympic National Park, the 848,000-acre mountain and forest wilderness of northwestern Washington. The ceremony was held on the grounds of Rosemary Inn, on the shores of mountain-surrounded Lake Crescent. On the program were Gov. Mon C. Wallgren, who as a member of the United States Senate had sponsored the legislation to establish the park; Senator Hugh B. Mitchell; and Representative Henry M. Jackson, in whose district most of the park is situated. The gist of Secretary Krug's important statement of policy regarding the preservation of the virgin timber of the park is given elsewhere in this report.

Scheduled for dedication ceremonies are Isle Royale National Park, Mich., on August 27, and Mammoth Cave National Park, Ky., on September 18.

Service Is Seriously Short of Personnel

To accomplish the tasks which the people and the Congress expect of the National Park Service and which are its responsibility under the law, and also to maintain needed protection and services under present conditions, there is a pressing need for additional personnel. The need of larger staffs in the field, to serve the tide of visitors now flowing in, is desperate. As indicated elsewhere, this need is made more critical by the 40-hour work week and overtime requirements. Almost impossible burdens will be imposed upon a loyal staff until further increases in appropriations make it possible to establish an adequate number of additional positions. Few areas are now sufficiently staffed to permit shifting hours of duty to the extent necessary for the conduct of operations 7 days a week; yet 7 days service must be given at most areas a large part of the year. A few of the smaller historical areas close 1 day a week—which gives the personnel some relief, but which also works a hardship on the visitor from afar who does not know in advance of such closing.

The personnel shortage is acute also in the Director's office in Chicago, the liaison office maintained in Washington, and the four regional offices. It perhaps hits hardest administrative and professional heads who now endeavor to carry on with little or no assistance, but whose efforts, for that reason, do little more than "plug holes in the dike." These responsible employees should have time to think and to work on fundamental problems. It is unsound, economically and professionally, to expect them to carry on without adequate staffs, to devote much of their time to clerical and minor professional tasks, and still to be ridden by the consciousness of work that needs doing but that must remain undone.

No more critical problem confronts the Service during the coming year than that of providing relief to conscientious and overworked personnel. Allied to this need is the necessity of reallocating the technical and administrative positions to bring them in line with those of similar responsibility in other Federal agencies. Until this is done, the Service cannot compete with other agencies in filing vacancies scaled one or two grades lower than comparable positions elsewhere.

The loyalty and high caliber of the Service staff is attested by the fact that few of its professional and administrative officials have been lured elsewhere by the prospect of higher salaries. It is not too much to say that money could not buy the devotion to duty that they have shown during the war years and during the months since the end of the war.

TABLE 1.—*National Park System, travel and area data, June 30, 1946*

[Travel figures for the fiscal year, July 1, 1940–June 30, 1941, the last full fiscal year before the war, are not available for comparison with those of the 1946 fiscal year. Figures for the travel year of 1941, therefore, have been included.]

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945–June 30, 1946	Approximate visitors, travel year Oct. 1, 1940–Sept. 30, 1941
NATIONAL PARKS				
Acadia	Maine	28, 382. 21	31, 424	423, 088
Big Bend	Texas	691, 338. 95	6, 379	(1)
Bryce Canyon	Utah	36, 010. 38	73, 780	124, 098
Carlsbad Caverns	New Mexico	45, 526. 59	295, 244	284, 024
Crater Lake	Oregon	160, 290. 33	97, 710	273, 564
Glacier	Montana	997, 486. 80	96, 878	179, 082
Grand Canyon	Arizona	645, 135. 91	333, 969	431, 816
Grand Teton	Wyoming	94, 892. 92	56. 604	125. 129
Great Smoky Mountains	Tennessee, North Carolina.	460, 882. 46	945, 468	1, 247, 019
Hawaii	Territory of Hawaii	173, 404. 60	418, 801	324, 728
Hot Springs	Arkansas	1, 019. 13	293, 461	203, 093
Isle Royale	Michigan	133, 838. 51	6, 122	7, 257
Kings Canyon	California	452, 904. 82	135, 183	172, 271
Lassen Volcanic	do	103, 269. 28	53, 752	108, 663
Mammoth Cave	Kentucky	50, 547. 51	104, 237	158, 772
Mesa Verde	Colorado	51, 017. 87	21, 713	42, 079
Mount McKinley	Alaska	1, 939, 199. 04	133	1, 700
Mount Rainier	Washington	241, 524. 77	398, 458	446, 636
Olympic	do	848, 212. 30	116, 624	92, 968
Platt	Oklahoma	911. 97	438, 450	316, 169
Rocky Mountain	Colorado	252, 625. 87	476, 098	685, 393
Sequoia	California	385, 100. 13	227, 211	300, 012
Shenandoah	Virginia	193, 472. 98	690, 413	1, 054, 479

See footnotes at end of table.

TABLE 1.—*National Park System, travel and area data, June 30, 1946*—Continue

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945–June 30, 1946	Approximat visitors, travel year Oct. 1, 1940-Sept. 30, 194
NATIONAL PARKS—continued				
Wind Cave	South Dakota	11, 718. 17	30, 589	21, 03
Yellowstone	Idaho, Montana, Wyoming.	2, 213, 206. 55	348, 880	581, 76
Yosemite	California	756, 294. 65	482, 913	594, 06
Zion	Utah	94, 241. 06	137, 987	190, 01
Total		11, 062, 455. 76	6, 318, 481	8, 388, 90
NATIONAL HISTORICAL PARKS				
Abraham Lincoln	Kentucky	110. 50	37, 666	115, 72
Chalmette	Louisiana	33. 25	51, 588	25, 40
Colonial	Virginia	7, 057. 16	378, 158	[2] 643, 03
Morristown	New Jersey	958. 37	257, 904	221, 77
Total		8, 159. 28	725, 316	1, 005, 95
NATIONAL MONUMENTS				
Ackia Battleground	Mississippi	49. 15	(3)	(3)
Andrew Johnson	Tennessee	17. 08	20, 500	(1)
Appomattox Court House	Virginia	968. 25	12, 800	[2] 50, 00
Arches	Utah	33, 769. 94	1, 371	3, 78
Aztec Ruins	New Mexico	25. 88	7, 154	12, 631
Badlands	South Dakota	122, 812. 46	75, 235	251, 498
Bandelier	New Mexico	27, 048. 89	16, 538	11, 727
Big Hole Battlefield	Montana	200. 00	1, 770	(1)
Black Canyon of the Gunnison	Colorado	13, 176. 02	7, 599	18, 444
Cabrillo	California	. 50	(3)	(3)
Canyon de Chelly	Arizona	83, 840. 00	1, 299	1, 916
Capitol Reef	Utah	33, 068. 74	(3)	(3)
Capulin Mountain	New Mexico	680. 42	16, 750	35, 550
Casa Grande	Arizona	472. 50	24, 582	18, 084
Castillo de San Marcos	Florida	18. 51	260, 192	297, 620
Castle Pinckney	South Carolina	3. 50	(3)	(3)
Cedar Breaks	Utah	6, 052. 20	18, 514	16, 516
Chaco Canyon	New Mexico	18, 039. 39	1, 466	1, 724
Channel Islands	California	1, 119. 98	(3)	(3)
Chiricahua	Arizona	10, 529. 80	8, 646	12, 069
Colorado	Colorado	18, 120. 55	25, 652	31, 333
Craters of the Moon	Idaho	47, 210. 67	10, 639	21, 796
Custer Battlefield	Montana	765. 34	33, 569	65, 132
Death Valley	California	1, 850, 565. 20	72, 499	96, 529
Devil Postpile	do	798. 46	(3)	(3)
Devils Tower	Wyoming	1, 193. 91	16, 197	32, 951
Dinosaur	Colorado, Utah	190, 798. 49	5, 355	9, 133
El Morro	New Mexico	240. 00	1, 217	1, 300
Father Millet Cross	New York	. 01	(3)	(3)
Fort Frederica	Georgia	74. 53	4, 900	(1)
Fort Jefferson	Florida	86. 82	5, 588	918
Fort Laramie	Wyoming	214. 41	7, 606	6, 747
Fort Matanzas	Florida	18. 34	9, 156	17, 055
Fort McHenry	Maryland	47. 64	439, 357	660, 403
Fort Pulaski	Georgia	5, 427. 39	(4)	55, 536
Fossil Cycad	South Dakota	320. 00	(3)	(3)
George Washington Birthplace	Virginia	393. 68	23, 413	52, 429
Gila Cliff Dwellings	New Mexico	160. 00	(3)	330
Glacier Bay	Alaska	2, 297, 456. 27	(3)	(3)
Grand Canyon	Arizona	196, 051. 00	46	(2) 324
Gran Quivira	New Mexico	450. 94	1, 131	2, 974
Great Sand Dunes	Colorado	36, 609. 19	6, 121	11, 171
Holy Cross	do	1, 392. 00	(3)	(1)
Homestead	Nebraska	162. 73	139	(1)
Hovenweep	Utah, Colorado	299. 34	132	299
Jackson Hole	Wyoming	173, 064. 62	(3)	(3)
Jewel Cave	South Dakota	1, 274. 56	1, 748	4, 901
Joshua Tree	California	655, 961. 33	35, 040	(1)
Katmai	Alaska	2, 697, 590. 00	(3)	(3)
Lava Beds	California	45, 867. 56	23, 325	34, 659
Lehman Caves	Nevada	640. 00	2, 402	(1)
Meriwether Lewis	Tennessee	300. 00	7, 552	21, 281
Montezuma Castle	Arizona	521. 41	11, 077	9, 435
Mound City Group	Ohio	57. 00	(3)	(3)
Muir Woods	California	424. 56	222, 471	133, 517
Natural Bridges	Utah	2, 649. 70	413	618
Navajo	Arizona	360. 00	351	566
Ocmulgee	Georgia	683. 48	32, 196	63, 330
Old Kasaan	Alaska	38. 00	(3)	(3)

See footnotes at end of table.

TABLE 1.—*National Park System, travel and area data, June 30, 1946*—Continued

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945–June 30, 1946	Approximate visitors, travel year Oct. 1, 1940–Sept. 30, 1941
NATIONAL MONUMENTS—con.				
Oregon Caves	Oregon	480.00	29,626	57,704
Organ Pipe Cactus	Arizona	328,161.73	75,484	9,780
Perry's Victory	Ohio	14.25	35,740	41,956
Petrified Forest	Arizona	85,303.63	199,390	240,967
Pinnacles	California	12,817.77	14,097	28,036
Pipe Spring	Arizona	40.00	1,046	1,914
Pipestone	Minnesota	115.60	3,889	2,785
Rainbow Bridge	Utah	160.00	(3)	367
Saguaro	Arizona	53,669.24	15,585	15,167
Santa Rosa Island	Florida	4,800.00	416,459	405,968
Scotts Bluff	Nebraska	2,196.44	43,842	80,206
Shoshone Cavern	Wyoming	212.37	(3)	(3)
Sitka	Alaska	57.00	3,987	9,151
Statute of Liberty	New York	10.38	529,140	446,364
Sunset Crater	Arizona	3,040.00	6,773	12,944
Timpanogos Cave	Utah	250.00	40,128	10,864
Tonto	Arizona	1,120.00	11,367	9,423
Tumacacori	do	10.00	17,014	8,912
Tuzigoot	do	42.67	8,708	9,350
Verendrye	North Dakota	253.04	(3)	(3)
Walnut Canyon	Arizona	1,641.62	15,804	12,623
Wheeler	Colorado	300.00	(3)	(3)
White Sands	New Mexico	140,247.04	72,345	79,069
Whitman	Washington	45.84	(3)	(3)
Wupatki	Arizona	34,693.03	2,349	4,153
Yucca House	Colorado	9.60	47	72
Zion	Utah	33,920.75	(3)	(3)
Total		9,283,794.34	3,016,528	3,749,452
NATIONAL MILITARY PARKS				
Chickamauga and Chattanooga	Georgia, Tennessee	8,146.33	206,050	371,616
Fort Donelson	Tennessee	102.54	18,885	41,908
Fredericksburg and Spotsylvania	Virginia	2,420.15	66,271	156,038
Gettysburg	Pennsylvania	2,463.46	397,259	654,411
Guilford Court House	North Carolina	148.83	30,098	53,203
Kings Mountain	South Carolina	4,012.00	26,601	24,442
Moores Creek	North Carolina	30.00	4,343	4,458
Petersburg	Virginia	1,324.62	147,413	263,169
Shiloh	Tennessee	3,717.59	157,894	233,439
Stones River	do	323.86	28,143	6,542
Vicksburg	Mississippi	1,323.56	14,654	212,154
Total		24,012.94	1,097,611	2,021,380
NATIONAL HISTORIC SITES				
Atlanta Campaign Markers	Georgia	20.96	(3)	(3)
Federal Hall Memorial	New York	.49	68,175	(3)
Fort Raleigh	North Carolina	16.45	24,882	76,016
Home of Franklin D. Roosevelt	New York	33.23	113,772	(1)
Hopewell Village	Pennsylvania	6,197.00	63,946	85,562
Jefferson National Expansion Memorial.	Missouri	82.58	33,940	(3)
Manassas Battlefield Park	Virginia	1,604.57	7,104	7,735
Old Philadelphia Custom House	Pennsylvania	.79	27,238	(3)
Salem Maritime	Massachusetts	8.61	6,714	7,172
Vanderbilt Mansion	New York	211.65	26,426	17,669
Total		8,176.33	372,197	194,154
NATIONAL BATTLEFIELD SITES				
Antietam	Maryland	183.32	26,056	32,165
Brice Cross Roads	Mississippi	1.00	(3)	(1)
Cowpens	South Carolina	1.00	407	(3)
Fort Necessity	Pennsylvania	2.00	57,968	81,803
Kennesaw Mountain	Georgia	60.00	25,139	14,450
Tupelo	Mississippi	1.00	(3)	(1)
White Plains	New York		(3)	(3)
Total		248.32	109,570	138,618
NATIONAL BATTLEFIELD PARKS				
Richmond	Virginia	684.44	17,035	(1)

See footnotes at end of table.

TABLE 1.—*National Park System, travel and area data, June 30, 1946*—Continued

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945–June 30, 1946	Approximate visitors, travel year Oct. 1, 1940–Sept. 30, 1941
NATIONAL MEMORIALS				
House Where Lincoln Died	District of Columbia	.05	66,226	32,883
Kill Devil Hill	North Carolina	314.40	20,461	84,194
Lee Mansion	Virginia	.50	304,433	358,791
Lincoln Memorial	District of Columbia	.61	681,932	1,796,752
Lincoln Museum	do	.18	106,335	52,541
Mount Rushmore	South Dakota	1,686.40	147,520	(1)
New Echota Marker	Georgia	.92	(3)	(1)
Thomas Jefferson	District of Columbia	1.20	661,508	(1)
Washington Monument	do	.37	751,382	939,458
Total		2,004.63	2,739,797	3,670,619
NATIONAL CEMETERIES				
Antietam [5]	Maryland	11.36	(3)	
Battleground	District of Columbia	1.03	2,700	(1)
Fort Donelson [5]	Tennessee	15.34	(3)	
Fredericksburg [5]	Virginia	12.00	(3)	
Gettysburg [5]	Pennsylvania	15.55	(3)	
Poplar Grove [5]	Virginia	8.72	(3)	
Shiloh [5]	Tennessee	10.25	(3)	
Stones River [5]	do	20.09	(3)	
Vicksburg [5]	Mississippi	119.76	(3)	
Yorktown [5]	Virginia	2.91	(3)	
Total		217.01	2,700	5,000
NATIONAL CAPITAL PARKS				
The Park System of the District of Columbia.	District of Columbia, Maryland, and Virginia.	27,790.36	(3)	(3)
PARKWAYS				
Blue Ridge	North Carolina, Virginia.	38,911.50	683,959	965,507
George Washington Memorial	Virginia	2,458.68	(3)	(3)
Natchez Trace	Tennessee, Alabama, Mississippi.	13,648.87	(3)	(3)
Total		55,019.05	683,959	965,507
Total—National Park System.		20,472,562.46	15,083,194	20,139,589
NATIONAL RECREATIONAL AREAS				
Boulder Dam	Arizona-Nevada	1,680,133.33	992,397	838,246
Lake Texoma	Texas-Oklahoma		(3)	(3)
Shasta Dam	California		(3)	(3)
Millerton	do		(3)	(3)
Total			992,397	838,246
PROJECTS [6]				
Saratoga National Historical Park.	New York	1,864.60	19,243	(1)
Kennesaw Mountain National Battlefield Park.	Georgia	3,034.21	(5)	(5)
Cape Hatteras National Seashore RA.	North Carolina	74.00	(3)	(3)
Olympic Public Works project	Washington	43,359.36	(3)	(3)
Total		48,332.17	19,243	72,591
Grand total		22,201,027.96	16,094,834	21,050,426

[1] Not established in 1941.

[2] Estimated.

[3] Travel figures not available or maintained.

[4] Closed to visitors.

[5] Included in travel figures for adjacent battlefield site, military park, or historical park.

[6] Includes only those in which lands are under National Park Service administration.

Office of Indian Affairs

WILLIAM A. BROPHY, *Commissioner*

THE fiscal year which ended June 30, 1946, was a period of change and movement for the American Indians as it was for the world at large. Not long after the fiscal year began, World War II ended. The 25,000 Indian men and women who had served in the armed forces and the 40,000 others who had engaged in war work had made a record which stood comparison with that of any other group.

The termination of the war, however, brought new problems to the Indians. Old problems were accentuated.

These became also the concern of the Office of Indian Affairs which protects the interests of more than 400,000 Indians, Eskimos and Aleuts, and strives to help them become self-governing and economically independent. This Office has responsibility under the direction of the Congress and the Department of the Interior for carrying out the provisions of the many treaties, agreements and laws which govern the relations of these citizens with the Federal Government.

Cessation of hostilities marked the beginning of a profound change in their fortunes. Wages from war work vanished. Dependency allotments sent home by servicemen and women began to dwindle as the armed forces diminished. A downward trend in family incomes set in.

Those incomes never had been adequate. Although in the war year of 1944 the individual income total was approximately 2½ times that of 1938, one-third of the Indian families resident on the reservations still had incomes of less than $500 in 1944 and nearly two-thirds received less than $1,000.

Balanced against this situation were new factors born directly or indirectly of war and wartime conditions. Many thousands of Indians who had never been far from a reservation had attained widened viewpoints in the military camps and in the factories of this country, and in the far reaches of the earth. New opportunities opened to some. The imperative need of adequate education was brought home to many. Standards of living had risen for thousands. Veterans had acquired benefits under the Servicemen's Act of 1944, as amended, and other legislation.

Indian Service Reorganization

In order better to solve the problems, old and new, and to render more efficient service to the Indians, a reorganization of the field installations throughout continental United States was prepared during this fiscal year for immediate operation with the beginning of the next fiscal year.

The reorganization, designed to increase administrative effectiveness, sets up five districts geographically, each including Indian Service installations within a group of States. Headquarters are at Minneapolis, Minn., Billings, Mont., Portland, Oreg., Phoenix, Ariz., and Oklahoma City, Okla.

More than 40 "at large" offices or stations were eliminated, their activities being taken over by the district offices to concentrate the technical services they performed. It was planned also to delegate to district directors and agency superintendents authority to act on many matters hitherto handled by the central office. This decentralization of authority from the central office and the concentration of technical services in the district offices was expected to cause on-the-ground teamwork which would result in greater promptness in meeting local and regional needs and in greater uniformity, since these needs are often not essentially local but are identical or similar over large, contiguous areas.

Delegation of Authority

A bill (H. R. 4386) designed to facilitate and simplify the administration of laws governing Indian affairs, was before the Congress during this fiscal year. It would authorize the Secretary of the Interior to delegate from time to time and to the extent and under such regulations as he deems proper, his powers and duties under those laws to the Commisssioner of Indian Affairs, insofar as the powers and duties relate to action in individual cases arising under general regulations promulgated by the Secretary. It also authorizes the Commisssioner to delegate various powers and duties to personnel in the field.[1]

Appropriations Consolidated

A very definite improvement of budgetary procedures was achieved during the year through the consolidation of appropriations from 116 titles to 29. This amounted to a complete revision of budget structure and has made for such efficiency that any interested person, looking at the 29 permanent titles, can tell how much the administrative expense is, and how much each one of the major activities such as education, health, forestry, etc., cost in 1 year. Previously there had been so many separate appropriations that the actual cost of administering the activities of the Indian Service could be ascertained only by a great deal of analysis.

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[1] The President signed the bill Aug. 8, 1946. It had been passed by the Congress during the fiscal year, but reconsideration of the vote was ordered by the Senate, which passed it July 29, 1946, with amendment. The House concurred July 30.

Postwar Changes

It is expected that the reorganization and the addition of new powers o field officials will be of considerable aid in their efforts to help Indians, Eskimos, and Aleuts faced by postwar difficulties. The new factors which accompanied the war and its termination were having their effects. There were plentiful evidences of that during the fiscal year, but it was still too early to determine whether there were any general war-induced trends which would persist in the future.

A question which presented itself was whether there would be any general drift away from the Indian homelands. None was discernible in preliminary reports from the reservations and Indian communities. Those reports did indicate that a large majority of veterans and war workers had returned.

There was the further question as to how many would remain and how many would take advantage of opportunities seen outside the reservations. Early in 1946, many of the reservations reported the belief that the great majority, and in some instances all, would remain. Military service in some cases seemed to have drawn veterans closer to their homes, as was reported at the Navajo Reservation in Arizona, New Mexico, and Utah, even though educational and economic opportunities there are poor. This trend is little different from that of the non-Indian population. The people were returning to their homes.

In various places, it was believed that some Indians would do as they had done in the past, take temporary employment outside when it was offered, but return to their own lands when employment ceased.

On the other hand, from the Shawnee Agency in Oklahoma came word that the war seemed to have made Indians there dissatisfied with opportunities for making a living on the reservation so long as they could get outside employment, but this was recognized to be merely an acceleration of a process which had begun prior to the war. A similar condition was reported at the Potawatomi Agency in Kansas where it was felt that participation in the war and in war work had speeded tremendously the processes of Indian assimilation into the social, economic, and political life of the United States.

Another report stated that some Indians had not returned to the reservation when their war jobs ended but had applied for relief money in the communities where they were.

It became clear that Indians of the postwar world were attacking their problems of readjustment according to no fixed pattern. Their approaches to the task were as varied as those of other citizens. For they earn their livelihoods according to the conditions which obtain in their environments. They are farmers, stockmen, fishermen, lumbermen, or workers in other occupations in accordance with the nature of the country in which they live. These and many other occupations are followed by Indians. Some never have lived on a reservation, but have earned their livings in city or town, on farm or ranchland far from reservations, and some even in foreign countries, and have little or no contact with the Indian Service.

Pueblo Food Offer

Concern of the native peoples with postwar difficulties has not been confined to their own. Last spring nine Indian Pueblos in New Mexico, having heard from their warrior sons that people were starving in Europe and Asia, acted with characteristic generosity. They sent the following communication to Fiorello H. LaGuardia, director general of the United Nations Relief and Rehabilitation Administration:

> This is the Governors of the Indian Pueblos in New Mexico that is writing you this letter. This is what we say. Our peoples been hearing lots about the peoples and childrens in Europe and China that are starving. So we been talking over with our Councils and we talk it together. So we write you this letter.
>
> Us Pueblo Indian peoples been living in this country long time. Our peoples they are good farmers but even if they good farmers they not raising much even in good years when lots of rain. Our peoples pray and dance for rain and live right but even in good years we raise only enough to feed ourselves. Our old custom tell us to save every year part of what we raise for like an emergency or crop failure next year. This not much but all we have.
>
> Looks like those peoples and childrens over there got emergency. Lots of our Pueblo boys that went to war for this country, now they back here. They tell us all they see. Our peoples proud of their sons and so glad they back home again to forget the war and live the right way for peace.
>
> Pretty hard for peoples and childrens to forget the war and live the right way for peace with empty bellies. So we say we haven't got much saved for our emergency but they got emergency over there so maybe we can help some. We got little corn and little wheat for that to be use. Our Superintendent tell us you are the man that is sending corn and wheat to them peoples and childrens over there so we write you this letter so take part of our corn and wheat for them peoples. That is what we say.

Eskimo Generosity

And when the school children in the little Eskimo village at Noorvik in Alaska were told by their teacher that people were starving overseas, they informed their parents. An auction sale of second-hand articles was held. A Treasury check for $40, the entire proceeds, was sent to UNRRA.

This was the donation of a village of 234 people who have their own food shortage every year. If the caribou fail to migrate near their village or if the spring is late and the seal do not come in at their regular time the people are apt to go hungry.

Aid to Veterans

Even before peace was an accomplished fact, the Office of Indian Affairs recognized that the welfare of the returned veteran was essential to future Indian economic and governmental independence. Preparations were made to give assistance. Reservation superintendents laid their plans.

They went into action when victory was won. In some instances, letters were sent to men and women in the armed forces as to their future plans and as to their desire for assistance.

Veterans had acquired new rights to education, vocational and academic, to financial aid if unemployed, and to Federal help in obtaining commercial loans to acquire homes or engage in business ventures. It was realized early that special action should be taken to encourage qualified Indian veterans to take advantage of the guaranty loan provisions of the G. I. Bill of Rights before seeking loans from tribal funds or the Federal revolving credit funds.

Consequently in November 1945 reservation superintendents and other Indian Service personnel were acquainted not only with the Indian veterans' basic rights, which are identical under the law with those of other veterans, but also with special provisions established by the Office of Indian Affairs to aid them in getting loans from commercial sources. While Indians may not mortgage or assign trust lands, it was provided that Indian agency superintendents may authorize the use of income from such lands as security for loans partially guaranteed by the Veterans' Administration. Another provision was that veterans, who have obtained loans on livestock, may authorize lenders to enter immediately upon the trust land upon default and to operate thereon the repossessed livestock for not more than 90 days, and the privilege holds good for stock operated on tribal lands, if the tribe gives consent. Other liberal provisions were made.

In localities where Indian veterans have found difficulty in obtaining funds from commercial lenders, efforts are made by Indian Service personnel to get for them the same kind of treatment that is accorded to other veterans. The use of tribal funds or of revolving credit funds, which are very limited, is encouraged only if a commercial loan cannot be obtained.

Tribal Help to Veterans

Tribes which are conducting lending operations have passed resolutions extending preference to veterans, and in other ways returning veterans have been given special consideration by the governing bodies of the tribes of which they are members. Sioux Indians of the Cheyenne River Reservation in South Dakota were so proud of their 376 young men and women in the armed forces that they voted a $25 bonus to each honorably discharged veteran, at a total expenditure of about $9,400.

Veterans in many instances have taken an active part in tribal affairs. One of the 16 tribal delegations which visited this Office during the fiscal year was composed entirely of veterans. Five others had one war veteran member each.

Personnel in all branches and components of the Indian Service has given assistance to the veterans. Establishment of veterans in income-producing enterprises through extension of credit and through formulation of adaptable farm plans has been a regular part of the program. Upon entering the armed forces many Indians did not liquidate their assets but left their livestock and farms in the hands of relatives, who carried on. Operations generally continued satisfactorily, and the returning veterans have found themselves able to readjust more readily.

On-the-Farm Training

Special attention has been given to on-the-farm training in cooperation with the Veterans' Administration and the Indian schools or, where possible, with the public schools. Under this program veterans who own or lease farms receive classroom instruction, and supervision and on-the-farm instruction by agricultural experts. They receive also the customary subsistence allowances under the Servicemen's Readjustment Act of 1944, as amended.

One of the most significant is the program at the Cherokee Central School on the Cherokee Reservation in North Carolina. Here approximately 70 veterans are farming under that plan. Supervisors in agriculture and livestock work help the veteran to plan his operations and supervise his work on the farm, as well as give him instruction at weekly sessions at the school. At this agency, 69 farm plans have been made for veterans during the fiscal year. Training in soil and moisture conservation is an important element.

Education for Veterans

Vocational training is another part of the educational program being conducted in cooperation with the Veterans' Administration. An example is the work at the Cherokee Central School where approximately 30 men engaged in this kind of training. It includes courses in carpentry, painting, plumbing, electrical work, automobile mechanics, and arts and crafts.

Indian Service schools enrolled a considerable number of returned veterans during the fiscal year. Haskell Institute at Lawrence, Kans., received 85 and Chilocco Indian Agricultural School at Chilocco, Okla., enrolled 43. Other veterans entered Sequoyah Training School at Tahlequah, Okla., Flandreau School at Flandreau, S. Dak., Albuquerque School at Albuquerque, N. Mex., Sherman Institute at Riverside, Calif., and Chemawa School at Chemawa, Ore. There was a consistent demand among veterans for high school studies and specialized vocational training.

On-the-job training has claimed the interest of many Indian veterans. It is carried on through cooperation with the Veterans' Administration. An outstanding example is a course at Menominee Indian Mills in Wisconsin, where members of the tribe operate a logging and lumbering business. More than 50 veterans undertook training in many of the technical phases of the lumber industry to fit themselves to do expert work, especially in the Menominee forest, which is managed in accordance with conservation principles and provides employment for 500 men.

Training of World War II veterans within the Indian Service has been arranged in accordance with an agreement between the Department of the Interior and the Veterans' Administration. In general, it will be restricted to present and prospective employees of the Indian Service, especially Indians. If an Indian Service unit, however, is especially equipped to carry on training in some field desired by veterans living on the reservation and if equivalent training is not available elsewhere, others than present or prospective employees will get the training.

Indian veterans have manifested a considerable interest in the various veterans' organizations. A number of all-Indian posts have been formed, and other veterans have joined posts the members of which are both Indian and non-Indian.

Indian Schools

The education of children in Indian schools still felt the effect of wartime conditions during the school year of 1945-46, corresponding to the fiscal year of 1946. There was, however, a small increase in the average daily attendance over that of the previous year. Daily attendance in the 1941-42 school year, before the influence of war was greatly felt, had been 25,839. It had declined to 21,828 in 1943-44, rose to 22,502 the following school year, and during this fiscal year the total was, in round figures, 22,770.

Family uncertainties growing out of shifts from war industry to other forms of employment were a factor in increased enrollment in nonreservation boarding schools, the daily attendance being 5,965 this year as against 5,500 during the previous year. Reservation boarding schools showed a slight decrease in attendance. Many Indian families, having lost wartime jobs, had not returned to the reservations and were wandering about the country. This uncertainty apparently was responsible for the failure of the Indian day schools to show a marked increase during this year. The daily average day school attendance this year was approximately 6,180 as against 6,086 the previous year and 7,870 during the 1941–42 school year.

Navajo Education

Efforts to meet the pressing educational needs of children on the vast Navajo Reservation were intensified during this fiscal year. The whole problem of Navajo education was being attacked. Population estimates, based on ration book distribution, indicated that there were at least 20,000 children of school age on the reservation. The Government provides facilities for teaching only 5,500.

There is room to accommodate 3,500 pupils in the day or community schools. The average daily attendance does not exceed 1,750. Maximum use has not been attained for several reasons. Roads for bus service have not been built in some areas. Also, bus service was made impossible in some places by the fact that road maintenance was largely discontinued during the war. Overcrowded Navajo boarding schools have cared for between 2,000 and 2,500 students although by accepted standards the dormitories are adequate for only 1,500.

During the current fiscal year, this difficult situation was further complicated by necessary abandonment of high-school dormitories at Shiprock, N. Mex., because of severe settlement in the walls; by abandonment of the entire school plant at Tohatchi, N. Mex., because of a break-down in the water and sewage distribution systems and the obsolence of the dormitories; and by abandonment of half the school building at Chinle, Ariz., because of severe settlement of one side of the foundations.

Request was made for a supplement to the 1947 appropriation bill for funds to provide facilities to replace those abandoned at Shiprock and Tohatchi. The request was approved and added to the appropriation bill. Consequently, new dormitories will be built at Shiprock on a new site on the mesa north of the flood plain where the present buildings are located, and facilities for about 180 pupils will be provided at Toadlena, where there is ample water and no danger of flood, as a substitute for the abandoned Tohatchi facilities.

Navajos Demand Schooling

So active was the interest of the Navajos themselves in education, as well as in added health and other facilities, that a delegation of 26 men, including members of the tribal council, a war veteran, and interpreters, visited Washington, D. C., last May and appeared before the Indian Affairs Committees and appropriations subcommittees of the Senate and the House, the Secretary of the Interior, and representatives of the Budget Bureau dealing with Indian Affairs. The need of education was stressed by the delegation, for the Navajos had come to realize lack of education was a handicap to tribesmen in all activities, including making a living, when off the reservation. Also they had been disappointed because many of their young men had been rejected for military service because of illiteracy. The delegation made definite requests for added health and other facilities and stressed the necessity of compliance by the Government with the treaty of 1868 which had guaranteed a classroom and a teacher for every 30 children of school age. The delegation outlined a desired group of boarding schools to provide facilities for approximately 10,500 pupils and requested the Government to build them.

Public Interest Manifested

Active interest in the Navajo educational problem was also evidenced by chambers of commerce, service groups, church organizations, the Genral Federation of Women's Clubs, other women's organizations, state and ocal governmental agencies in Arizona and New Mexico, and the Indian welfare organizations. Two representatives each from the Arizona and New Mexico state departments of education conducted a week's survey of Navajo schools. They submitted a report discussing the need for new schools, the inability of the Government to operate all existing schools because of lack of teachers, irregularity of community school attendance due to bus service inadequacy, obsolescence of boarding school buildings, overcrowding of dormitories, and other inadequacies.

Excerpts from the report follow: "We found that much scientific study and research has been done to develop a curriculum to meet the needs of all pupils attending the schools * * * Well-chosen teaching materials have been provided for the teachers to enrich pupils' learning and aid in the development of accurate concepts about the world in which all people live. The curriculum corresponds very closely to that of many of the southwestern States, especially of the public schools of Arizona and New Mexico where there is a non-English speaking group to be considered * * * The Navajo schools are already serving as community centers, and there is an impressive adult participation in activities."

Complexity of the Problem

The Navajos consider education their paramount need, for they see the day as not far distant when thousands of their fast-growing population will leave the reservation, since its resources will not be able to support all of them. But the education problem is complex, for these are a nomadic people for the most part, following their flocks on a 16-million acre area, which is larger than the State of West Virginia. School sites must be selected and buildings erected to serve the needs of the greatest number. The types of schools must be determined, day schools where feasible and boarding schools where necessary. Roads must be built to transport the pupils to and from the schools.

It has been the endeavor of this Office to find the answer, and the effort will continue during the next fiscal year. As a supplement to the studies which have been and are being made, Dr. George I. Sanchez of the University of Texas, an authority on rural education, was commissioned to make a comprehensive survey during the summer of 1946. The results of these studies will be translated into added educational facilities as funds are made available.

Dearth of Teachers

The fiscal year of 1946 brought considerable difficulty in attracting teachers. That was partially due to uncertainty as to when the Civil Service would announce qualifying examinations for teaching positions and terminate the war service and temporary appointments held by a large number of Indian Service teachers. Permanent public school positions, even at lower salaries, were more attractive to many than the uncertainty as to their remaining in the Federal service.

Schools in Alaska

Measures to improve opportunities for education of the Alaskan native peoples, the Indians, Eskimos and Aleuts, were also taken during the fiscal year. During the depression years the expansion of the day school and the boarding high school program in Alaska was brought almost to a halt. There are now approximately 2,600 of these children living in villages where there are no schools. Approximately 125 pupils, completing their studies in the 118 elementary day schools, could take advantage of an opportunity to attend the junior high school and later go on to senior high school if the facilities existed. Since Alaskan villages are small and distributed over wide areas, all secondary school education has been carried on in three boarding schools, Wrangell Institute in southeastern Alaska, Eklutna in the Cook Inlet area, and White Mountain on Seward Peninsula. There is immediate need for space for at least 200 more such students.

The war brought serious social changes to the native peoples of Alaska. War work which moved many Indians and Eskimos to installations of the armed forces, increased liquor consumption, and prostitution of some of the women, and the general displacement of many caused a great increase in juvenile dependency and delinquency. Many children were neglected by their parents and exposed to immoral conditions. With lack of paternal supervision, childish mischief often grew into serious delinquency. Only private institutions exist in Alaska for the care of dependent children.

During the fiscal year the Navy announced its intention of terminating activities at the Sitka Naval Base on Japonski Island near the town of Sitka, and the Congress authorized the Secretary of the Navy to transfer the property to the Department of the Interior for the use of the native peoples of Alaska. Plans were made to utilize the buildings at the base to conduct a 600-pupil boarding high school on the island.

On this basis, it has been planned then to utilize Wrangell Institute with its capacity of 200 and Eklutna with a capacity of 300 as elementary boarding schools, with White Mountain to continue as a high school for 70 Eskimo children. An average daily attendance of 400 was expected at the Sitka school during the first year of operation. This would include a limited number of elementary pupils from remote areas which have no day schools.

Health for Alaskan Native Peoples

Medical care for Indians, Eskimos and Aleuts of Alaska, which is inadequate at present, should be greatly improved through a program approved during this year. Particular attention has been paid to treatment of tuberculosis. The average annual death rate from tuberculosis during the past 7 years among these people in Alaska has been nearly 7 per thousand, and there is now but one sanatorium for tuberculosis, a 150-bed former Army hospital of temporary construction at Skagway.

After a comprehensive study the Federal Board of Hospitalization approved a program, recommending the acquisition of a 200-bed tuberculosis sanatorium in southeastern Alaska, a 300-bed tuberculosis sanatorium, plus 100 general medical and surgical beds, in the Anchorage area, and 60 general medical and surgical beds for northwestern Alaska, to replace existing unsatisfactory structures, and to establish additional beds at existing locations or at a new location.[2]

Funds were appropriated by the Congress for construction of the first unit, a modern 200-bed tuberculosis sanatorium on Japonski Island. Plans for its construction were initiated during the latter part of the 1946 fiscal year. A tuberculosis control unit composed of a medical officer, a public health nurse, a technician and a clerk will be equipped with a mobile X-ray and will conduct tuberculosis-finding programs among the various villages.

Scope of Health Service

Medical and surgical services accorded by the Indian Service in continental United States and Alaska during the fiscal year had an estimated value of not less than $10,000,000. Seventy-six hospitals and sanatoriums, including 6 tuberculosis sanatoriums in the United States and 1 in Alaska, were operated. Supervision was given to 14 school health centers and to the activities of two hospitals operated by tribal funds. These institutions have a total bed capacity of 4,080, including 1,244 for tuberculosis. Care is also given at various State, county and private institutions under contracts with the Indian Service.

During the year 921,123 out-patient treatments were given to 558,201 individuals in hospitals and field dispensaries, and 39,582 patients were admitted to hospitals for a total of 820,267 in-patient days of treatment. Nearly one-fifth of the patients received major surgical treatment, and a large number had minor surgical care.

The serious shortage of physicians and nurses continued throughout the fiscal year with only slight relief. The nurse shortage was somewhat alleviated by utilization of senior cadets of the United States Cadet Nurse Corps in some of the hospitals. Some of the cadets, 136 of whom were graduated from courses in 10 Indian hospitals, will enter the Indian Service on a permanent basis.

Indian Cooperation in Health Measures

Education in measures of health protection and preservation have been continued with field nurses, education personnel and physicians taking an active part. In many places the Indians themselves are contributing much to the success of health educational measures by serving on health committees of tribal councils, and by other activities. Some of the tribes have adopted important health protective ordinances during the year. Some have passed resolutions favoring the adoption of complete health laws and regulations. These combined efforts seek to reduce communicable diseases and infant mortality and to improve personal hygiene, nutrition, and sanitation of the home and the community.

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[2] The President approved the program Aug. 7, 1946.

Tuberculosis continued to be prevalent among most of the tribes. Case-finding X-ray surveys were conducted on the Wind River Reservation, Wyo., Winnebago Reservation, Nebr., Crow Creek Reservation, S. Dak., and Pierre School, S. Dak. Increasing interest has been shown by Indians in these activities, according to reports.

Tuberculosis Prevention Study

Results were carefully analyzed of a study, begun in 1936, by which groups of Indians were given BCG (Bacillus Calmette-Guerin) vaccination to protect against tuberculosis. The procedure has proved of benefit, and it is planned to increase the number of those protected by extending vaccination to reservations with an unusually high tuberculosis morbidity.

The study group consisted of 3,007 persons, aged from 1 to 20 years. Of these, 1,550 were vaccinated, 1,457 were not. These persons were followed for 6 years with annual tuberculin tests and chest X-ray examinations. Results showed that BCG vaccination was associated with marked protection. Only four persons who had been vaccinated died of tuberculosis while 28 persons of the other group succumbed to the disease. Among those vaccinated, 40 contracted tuberculosis as against 185 in the other group.

Other Diseases Fought

Trachoma, an eye infection formerly prevalent among Indians, has been reduced to a low level of incidence. Reports now indicated that approximately 7.2 percent of all individuals examined have that infection. Cases discovered in routine school and clinic examinations are treated with sulfanilamide, the effectiveness of which as a remedy was discovered by the Indian Service medical staff.

The veneral diseases have decreased in prevalence in some areas and have increased in others. Penicillin, remarkably effective in the treatment of those diseases, is being used widely in Indian Service hospitals and clinics. In many areas Indians have been admitted to rapid treatment centers of State health departments for treatment of those diseases.

The year was notable for the absence of large epidemics of the communicable diseases, whooping cough, measles, chicken pox and influenza.

Those diseases occurred with less frequency than usual. A widespread program of vaccination was undertaken in Northwestern States and in Alaska when smallpox broke out in a virulent form at Seattle, Wash. So far as is known, the epidemic did not spread to Indian reservations.

Nurse Classification

Professional classification of nurses of the Indian Service has been requested in an effort to raise their salaries to an equivalent of those paid by other nurse-employing agencies and to promote morale by the additional prestige of a "professional" classification. At present field nurses, hospital staff, head nurses and chief nurses are classified in the subprofessional grade, whereas district and central office nurses alone enjoy the professional classification.

Use of Indian Lands

Just as the Indian Service, in partnership with Indian tribal and other organizations, acts to provide ever better health and education facilities, so does it assist the Indians to make the best use of their material resources to produce increasingly better livelihoods, and so does it protect their ownership of them.

Chief of these resources is land. This land belongs to the Indians—to individuals, tribes, bands, and other groups. It is held in trust for them by the Government but it nevertheless is the private property of the Indians. During this fiscal year and, in fact, in previous years, there have been indications of a growing concept in some places that Indian land and its oil, timber, minerals and other resources, are fair game for the taking. The Office of Indian Affairs has been vigilant to oppose any attempt to raid these resources. It repeatedly has made clear the fact that the Federal Government holds these resources as trustee for the Indian owners.

The Office of Indian Affairs has jurisdiction over land areas amounting roughly to 57 million acres, nearly all of which is held in trust for Indian tribes and individual Indians. Of this, approximately 31 million acres are classified as open grazing land and are valued at about $90,000,000. Another 16 million acres are forest and woodlands worth about $170,000,000, including the standing timber and reproduction and protection value. Approximately 7 million acres are agricultural lands, valued at $100,000,000. Barren and waste lands comprise about 3 million acres. Alaskan lands are not included in those figures, because the process of determining and confirming Indian, Eskimo, and Aleut occupancy rights there has barely begun.

In general, the homes and buildings on these Indian lands are poor. They are estimated to be worth not more than $15,000,000.

The land available for Indian use is insufficient in quantity and quality to support their entire population. About 7 million acres of the best lands are practicably unusable by Indians because their ownership is scattered in small, undivided interests. During the war years no appropriations were made for land acquisition under the authority of the Indian Reorganization Act, and there was insufficient personnel to prosecute successfully the readjustment of the Indian land ownership pattern. Thus maladjustments multiplied during that period. Return of veterans and war workers to Indian lands complicated the task of providing sufficient land.

Inflated land prices throughout the country have resulted in a flood of applications to this Office for sales of Indian trust lands and patents in fee. Sales and the issuance of patents in fee have been limited to the lowest possible number since the total Indian land base is inadequate for their support on many reservations particularly those where land had been allotted to individuals in the past.

Land Acquisition

During the year, 236,790 acres, which formerly had been opened to the public for settlement, were restored to tribal ownership on the Uintah and Ouray Reservation, Utah. Those lands had not been settled because of their low grazing value and their distance from water.

Approximately $203,000 of the Indians' own tribal funds were spent during the fiscal year to purchase about 49,000 acres on the following 13 reservations: Southern Ute, Colo.; Blackfeet, Flathead, and Fort Peck, Mont.; Consolidated Chippewa, Minn.; Navajo, N. Mex.; Seneca-Cayuga, Okla.; Warm Springs, Oreg.; Colville, Makah, and Tulalip, Wash.; and Wind River, Wyo.

The Indians of these and a number of other reservations are planning to carry on the land acquisition program, and have been authorized by the Congress to spend $304,000 of their own tribal funds for the purpose. It should be noted that this expenditure will use up a large part, and in many cases all, of the tribal income, and that it is being done for the common good.

Many tribes have no income and must depend upon the Congress for appropriation of funds to acquire necessary lands. Under the authority of the Indian Reorganization Act, the Congress appropriated $350,000 for the purchase of lands for needy Indians and returning Indian veterans for the 1947 fiscal year. This was the first such appropriation since 1942.

Tribal funds and those appropriated by the Congress will be used in the purchase of lands where Indians actually need and will use them. It will be good land in localities predominantly Indian where there is urgent need for improving the land ownership pattern. So far as possible, purchases will be limited to acquiring the badly fractionated heirship interests in the lands of old or otherwise incapacited Indians and trust lands belonging to those who permanently reside outside of the reservations. Purchase and consolidation of heirship interests belonging to nonresidents will aid Indians who can use the land, and at the same time aid the needy. Since complex heirship interests and allotments of nonresidents are not taxable, this will not take lands from State tax rolls.

Interest continued to grow on the allotted reservations for the return of scattered undivided equities in trust lands and trust allotments to ownership by the tribes in exchange for assignments granting life use of economic units of tribal lands, or shares in farming and grazing lands.

For five decades the ownership of Indian lands has become more complex because of the division of ownership through inheritance. The desire of the Indians to regroup their land holdings for better use reached a high point this year.

On the Rosebud Reservation in South Dakota, more than 20,000 acres were exchanged for shares in the Tribal Land Enterprise. Several hundred other applications for exchange were waiting action. This enterprise now manages nearly 60,000 acres and has continued to pay annual dividends of 4 percent to its shareholders.

At the Cheyenne River Reservation in South Dakota, Indians are continuing to convey their allotments and heirship interests to the tribe for exchange assignments. In this fiscal year, 336 full allotments and 325 partial allotments totaling 120,000 acres were so transferred. To date, nearly 300,000 acres have been returned to tribal ownership for exchange assignments on this reservation. In addition, many mutually advantageous exchanges have been made with non-Indians and with counties. The land ownership pattern thus has been greatly improved, and administrative costs and work have been lessened.

A number of other tribes have perfected land management enterprises. Operation of them will begin in the coming fiscal year.

Indian Lands for Military Purposes

During the war approximately 839,500 acres of Indian lands were used for air bases, gunnery and bombing ranges and other purposes related to the military program. Approximately 251,800 acres were sold by individual Indians. Of the balance, 556,800 acres and 30,900 acres of tribally owned land were used through lease and under permit, respectively. The lands are within the following localities or reservations: Alaska; Colorado River, Gila River, Walapai, and Papago Reservations, Ariz.; Palm Springs, Calif.; Fort Hall, Idaho; Blackfeet, Mont.; Carson and Western Shoshone, Nev.; Navajo and United Pueblos, N. Mex.; Five Civilized Tribes and Kiowa, Okla.; Pine Ridge and Cheyenne River, S. Dak.; and Klamath Agency, Oreg.

Surrender of homesites caused considerable hardship due to inability of many to find other desirable homesites at reasonable prices or, in fact, at any price. Surrender often was effected with the expectation that the lands would be returned to them after the war, especially since prices paid by the Government were considerably less than the cost of acquiring comparable property elsewhere, particularly in view of the general increase in property values. Formal recommendation has been made for the return of these lands to Indian ownership, as released. However, to date none has been returned.

Indian Agricultural Income

Since the principal resource of Indians is the land, it follows that their chief source of income is from agriculture. Their largest single industry is cattle raising.

Comparative figures show the real progress which Indians have made as agriculturalists. In 1940 they sold an estimated $9,124,000 worth of all agricultural products, and themselves consumed in the home approximately $4,770,000 worth. In 1945, their sales amounted to about $22,619,000, and the products consumed in the home were valued at approximately $9,288,000. It is estimated that, after deduction of farm and livestock expenses, the net agricultural income, including home-consumed products, was in the neighborhood of $21,898,000.

Growth of their livestock industry is demonstrated by the fact that in 1932 their income from sales of livestock and livestock products was less than $1,300,000, whereas in 1945 they received $16,376,000. During the latter year the eight reservations in Montana and Wyoming alone produced and marketed 9,224,584 pounds of dressed beef, 3,280,200 pounds of dressed lamb and mutton, 332,550 pounds of dressed pork.

Part of the increase in Indian agricultural income is due to improved economic conditions. Increased activity, however, accounts for much improvement. Technical and financial assistance is furnished by the Indian Service for these activities which produce income for the Indians.

Credit for Indians

Lack of capital long hindered the Indians in their efforts to be really self-supporting. A revolving credit fund established by the Indian Reorganization Act of 1934 provided the necessary capital they lacked prior to that time. As money is repaid by borrowers, the principal and the interest payments revert to the original fund and are available for additional loans.

As of June 30, 1945, loans totaling $6,614,000 had been made from the credit fund. That figure includes loans from moneys appropriated and from money repaid by Indian borrowers. Since repayments cannot be made unless the enterprises financed are successful, some indication of the utility of the system may be gained from the fact that repayments of $3,279,640 have been made. Only a meager sum, $14,459, is currently past due. The due dates on loans totaling $251,929 have been advanced through refinancing. Losses to date have amounted to $2,746. It must e remembered, however, that the past 5 years have been ones of increasing rices, and that, to some extent, has influenced the phenomenally successful peration of the credit fund.

Supplementing revolving credit funds, the Congress has authorized the se of tribal funds totaling $3,529,898.

Credit Without Money

Still another type of credit, which is unique in the Indian Service, calls for repayment "in kind." Some of the cattle purchased by the Government from distressed stockmen as a relief measure during the drought years in the thirties were turned over to the Indian Service. These were transferred to Indians who had feed and range available. They signed contracts to repay one animal for each received. Those which were repaid were loaned to other Indians similarly.

This program has been participated in by 12,718 Indians. A total of 42,717 animals are owed to the United States as of December 31, 1945. The revolving feature of the program is illustrated by the fact that 67,629 head have been repaid since the system was initiated.

Effects of Credit

The needed capital, as well as instruction and aid by Indian Service experts, and better economic conditions have helped the Indians greatly to increase their assets and thus attain a higher standard of living. Better livestock has been acquired, its quality has been improved, and the Indians have increased feed production to maintain their animals. Repayment schedules convinced many that to meet the due dates they often must cut down living expenses, which could be reduced by growing gardens. So more garden produce was raised.

Studies made this year disclosed many instances of Indians aided by a little capital, which meant to them the difference between poverty and a comfortable living. One may be cited.

In the spring of 1941, a 39-year-old Indian was granted an assignment of land by an Indian band. He had spent the greater part of his life as a roustabout for non-Indian ranchers, on highway jobs, PWA, and odd jobs generally. Sometimes he earned a little by trapping coyotes.

When he arrived at his land assignment his total assets were 34 cents, a horse and a saddle, but he knew what he wanted. He worked hard, repairing fences, irrigating hay land, harvesting hay, and doing other necessary jobs. He borrowed $1,500 from the revolving credit fund and purchased livestock and equipment. A checkup in the fall of 1945 showed that he had tripled the number of his cattle, had an agricultural income of $1,274, had 66 head of cattle, and other property valued at $2,712. He had reduced his indebtedness to $510 and had a net worth of $6,664.

Shortly after going to his assignment he married. His wife also had an assignment. They kept their cattle on an individual basis, but the combined net worth of the couple was $11,722 last fall.

Indian Response to Food Crisis

Numerous Indian tribes this spring recognized the world-wide need for food to feed the distressed people of other lands. The following statement of the Coeur d'Alene Indians of the Northern Idaho Agency is typical of their action: "Because of the very urgent need for an additional food supply for ourselves and the world at large, we hereby pledge to use all available means to have the Coeur d'Alene Indians produce all the additional food that is possible."

In 1945 farms operated by the Indians produced field crops, including forage, grains, and vegetables, with a gross value of $12,845,000. The products which they sold brought them approximately $5,174,000. Home-consumed food was valued at $851,520. Much of the forage and cereal grains was fed to their own livestock.

4–H Club Work

Indian youth have taken an active interest in 4–H Club work, which supplemented classroom work with instruction and practical experience in agriculture and home-making. There were 597 of these clubs in 1945, with a total membership of 2,189 boys and 2,595 girls. County prizes were won by 760 of them, and state prizes by 26. The total estimated value of all Indian 4–H Club products was $173,991.

Indian Forests

Indian forests during the calendar year 1945 continued to supply a large amount of timber for war and reconversion purposes. A total of 2,661,873,00 feet was cut during the fiscal year of 1941 and the 4 war years, 1942–45.

The 1945 cut was 475,662,000 feet as against 528,472,000 feet the previous year. The reduction was due in large part to labor strife in the lumber industry following the end of the war.

Indian sawmill operations on the Menominee, Red Lake, Navajo, and Fort Apache Reservations produced approximately 29,218,000 feet of lumber during the fiscal year of 1946.

White pine blister rust control continued during the year in cooperation with the Bureau of Entomology and Plant Quarantine of the Department of Agriculture. Initial eradication work has been performed on 83,307 acres, and 51,436 acres have been reworked, in the white pine control areas located principally in the Lake States.

During 1945, there were 973 forest fires on Indian lands, burning 118,33 acres. This was somewhat lower than the annual average of 998 fires uring the war years, beginning in 1942. Indian forests totaling 39,685,61 acres were under fire protection in 1945, at a cost of only $238,512. The ndians are indeed fortunate that the losses have been so small with the mited amount of fire protection funds available.

Grazing

During the calendar year 1945 approximately 44 million acres of forest nd open range lands were grazed, providing forage for about 9 million attle months. Of this area approximately 34 million acres were grazed y Indian livestock. The cash receipts for grazing privileges were approxinately $2,098,000. The value of free use to Indians was about $887,000.

Full use of the range was maintained during the year consistent with he principles of conservation, except in the Southwest. Continued difiiculty was experienced with overstocking in this area where a severe drought has further complicated a serious problem. Since the range lands of a number of the Southwest reservations will not support a sufficient number of livestock to provide a reasonable standard of living, reductions to grazing capacities have proceeded slowly. Progress, however, is being made in spite of difficulties.

Fish and Game

The taking of fish, wild game, and furs and skins, continued to be of considerable importance in the economic welfare of the Indians both for domestic use and for commercial purposes. Exclusive of Alaska, the 1945 take by Indians consisted of 5 million pounds of fish, 1 million pounds of game and over 60,000 furs and skins with a total over-all value in excess of $1,250,000. Almost all of the big game was for home consumption, but commercial fishing has developed into important enterprises on several reservations, and over 4 million pounds of fish were sold last year.

Several tribes are showing significant interest in wildlife conservation and are seeking ways to increase their wildlife resources. Indian Service encouragement and assistance in wildlife development and management should be extended to improve these valuable resources.

Oil on Indian Lands

Oil and gas prospecting and leasing activity on Indian lands, kept at a high rate by military requirements for petroleum throughout the period of the war, has shown no sign of slackening with the termination of hostilities. Postwar domestic and world demand has exceeded estimates, and though production has been approaching the wartime peak, the search for new reserves continues apace.

Forty-one lease sales were held during the fiscal year, resulting in the sale of 1,082 in the midcontinent area, 13 leases in Arizona, New Mexico, and Colorado in the southwestern area, and 16 leases in Montana, Wyoming, and Utah in the Rocky Mountain area.

Some of the major developments of the year in exploration of Indian lands were the deep drilling projects in the Anadarko Basin in Oklahoma, extensive activity on the Uintah and Ouray lands in the Uintah Basin in Utah, where approximately 20 geological and geophysical survey crews were active, a vigorous exploratory play in the San Juan Basin of New Mexico, Utah, and Colorado, and Madison lime pool development in the Cut Bank Field, Mont. Wildcat leases were approved covering unexplored areas on Mississippi Choctaw lands in Mississippi, and allotted lands of the Quinaielt Reservation, Wash., where test wells are to be drilled during the coming year. Special prospecting permits with rights of lease selection, covering some 300,000 acres on the Wind River Reservation, Wyo., and the Laguna Pueblo, N. Mex., where sold at competitive bidding.

Production from the thousands of stripper wells on Indian lands in Oklahoma was supported by the 35 cents a barrel subsidy payment. Petroleum price controls were continued throughout the fiscal year but ended at the close of the year. Prices then advanced 25 cents a barrel in most areas.

A new 8-inch, 32-mile high pressure natural gas pipe line is being laid to serve the isolated Barker Creek Dome high pressure wells on the Ute Mountain lands in Colorado. Shipment of oil started from a new discovery on the Sheldon Dome, Wind River Reservation, Wyo.

Statistics follow:

Number of leases in force at end of year	6, 602
Total acreage leased during the year	169, 442
Total acreage under lease at end of the year	1, 759, 040
Number of producing oil wells drilled during the year	222
Number of producing gas wells drilled during the year	25
Number of dry holes completed during the year	118
Total number of producing oil wells at end of year	11, 393
Total number of producing gas wells at end of year	480
Gross oil production for the year barrels	21, 607, 310
Income to Indian owners from oil and gas leases during the year	$6, 148, 518

Mining

A total of 51 mining leases, other than oil and gas, were issued during the year. The following leases and permits were in force at end of year (not including numerous sand and gravel permits): Vanadium, 8; vermioulite, 1; pumice, 5; limestone, 11; lead and zinc, 40; coal, 79; gypsum, 4; tungsten, 3; gold-silver, 3; copper, 3; asphalt, 5; asbestos, 4; manganese, 6; and black sand tailings, 1, totaling 173.

Royalty, rental and bonus income received by Indian owners during the fiscal year amounted to $564,938.

Irrigation

The demand for irrigation on Indian lands has been increased by the return of Indians from military service and from war work. During the war years the irrigation systems on Indian reservations, in common with other irrigation projects, were operated to meet demands for food production rather than for the future needs of the systems. That program was made necessary by sacrifices of manpower, vital construction materials, and equipment. The more permanent types of maintenance often were neglected. Rehabilitation of irrigation systems, completion or extension of existing systems and surveys looking toward development of all irrigable Indian lands are elements of the postwar program.

About 535,000 acres on more than 250 Indian Service projects were irrigated during the calendar year of 1945. During that year those lands, including Indian lands operated by Indians or leased by them to other persons, and non-Indian-owned lands, produced crops valued at more than $32,000,000, which was approximately one-half the total cost of construction of the projects involved and which was $1,500,000 greater than the 1944 crop value.

Because of the drought in the southwestern area and consequent deficiency in water supplies, the area irrigated was reduced by about 4,000 acres on the San Carlos project in Arizona and by about 3,000 acres elsewhere in that State. The Flathead project in Montana, however, reported an increase of 3,000 acres.

Indian irrigation projects vary in size from 2 or 3 acres to such major projects as the Flathead, the San Carlos, and the Wapato in Washington, with designated irrigable areas of 100,000 acres or more. The smaller units are generally subsistence gardens which supplement wages by production of table foods, or, when livestock is the principal economy of the reservation, can be used to produce supplemental winter feed.

With the exception of 50,000 acres of non-Indian lands on the San Carlos project, which are operated by an irrigation and drainage district, Indian irrigation projects are operated and maintained by the Indian Service. Some of the smaller units are operated and maintained by the Indians themselves without assistance from the Government except for general supervision.

Soil and Moisture Conservation

Soil and moisture conservation operations were conducted on Indian lands during the year to the full extent of the limited funds and facilities. The demand for expert aid in conserving the soil far exceeded the ability of the Service to provide it.

Land use plans were made during the year on 60 project areas for 1,200 farm and range units, comprising an aggregate of 1,528,000 acres. A total of 2,694 farms were protected by contours, terraces, stripping, cover crops, improved pastures, better rotations and land use, prior to and during the war. That, however, is a small part of the approximately 78,500 farm and range units on Indian lands to be protected from increasing erosion and soil wastage.

Indian lands in common with other lands have been used unwisely, but interest in soil and moisture conservation has increased. Limited funds have been insufficient for Indian Service cooperation with many soil conservation districts, organized under the laws of the various States. Superintendents of many Indian reservations have been requested by local bodies to aid in the common problem.

Where possible, the Indian Service furnishes technical assistance to conserve Indian lands, and the operators of the lands do the work. In many instances Indians who rent their lands are insisting that the operators employ conservation practices.

Some Indian farmers with the most rudimentary equipment are practicing conservation. A unique feature of work being done by 69 Cherokee war veterans in North Carolina is the establishment and improvement of productive and protective pasture cover by hand seeding and hand fertilization on mountain slopes so steep that animal or tractor-drawn implements cannot be used. The Choctaw Indians in Mississippi are terracing, strip cropping, making sodded waterways, fertilizing and improving pastures, and carrying out a program of progressive conservation farming, usually with no more than mules and simple farm equipment.

An operation on the Nez Perce and Coeur d'Alene Reservations in Idaho illustrates the value of such programs. Land use plans on 252 farms brought about the use of sweet clover, instead of clean fallow, between wheat crops, adding surface protection, nitrogen and organic material. The result was a wheat yield on 8,700 acres which was 100,000 bushels greater than that of last season. Application of complete conservation plans on 534 farms in Oklahoma increased returns by an estimated $70,000 during 1945.

Ultraextensive soil surveys and land classification in the great plains area have enabled the Indian Service to provide 899,750 acres for the production of much-needed additional wheat and flax. They also served to forestall a repetition of injudicious use and land destruction which followed the promiscuous breaking of sod land during World War I.

In the Southwest, spreading of flood water on 72,220 acres has contributed to increased forage production and the reduction of siltation in reservoirs. Accomplishments on 60 Indian Service projects include: Brush control, 1,663 acres; canals, 65 miles, gully checks, 282; contouring, 66,240 acres; cover crops, 36,500 acres; crop improvement, 4,000 acres; crop residue culture, 17,720 acres; dams, diversions and ponds, 611; dikes and levees, 648 miles; drainage, 5,760 acres; drops and turnouts, 1,115;

fencing, 276 miles; field laterals, 25 miles; gully control, 80 miles; commercial fertilizer, 4,980 acres; jetties, 790; soil survey and land classification, ,462,600 acres; land levelling, 335 acres; liming, 1,510 acres; barnyard manuring, 3,700 acres; meadow strips, 170 acres; pasture mowing, 7,460 acres; shaped and sodded terrace outlets and watercourses, 41 miles; pasture and meadow renovation, 4,330 acres; pest and rodent control, 20,000 acres; rotations, 886,000 acres; rough tillage, 45,500 acres; seed grown and collected, 4.3 tons; seeding and planting, 11,900 acres; spring developments, 28; ponds stocked with fish, 35; streambank protection, 8 miles; strip cropping, 7,080 acres; farm terraces, 228 miles; trees and plants grown, 214,000; planted 192,691; waterspreading, 83,875 acres, and 47 wells developed for livestock water.

Reseeding by Airplane

A novel experiment in reseeding by airplane selected Indian lands in Arizona with hardy grasses was begun during this fiscal year in cooperation with the Office of Land Utilization. Areas totaling 50,000 acres, where the natural vegetative cover had been impaired, were chosen. Results, which are being watched throughout the Southwest, should be seen during the 1947 fiscal year.

Arrangements were made with a contractor to reseed 10,000 acres on the Papago Reservation, 20,000 acres on the San Carlos Reservation, and 20,000 acres on the Hopi and Navajo Reservations. Work on the Papago was completed in June 1946 and operations on the other reservations were planned for the following months.

On the Papago Reservation seeds of Lehmann's lovegrass and of sand dropseed were used. These were encased in pea-sized pellets of clay with a binder. Also contained in the pellets were tiny amounts of fertilizer and of chemicals to repel rodents and insects. These were scattered by a rotor device in the airplane in accordance with an established pattern of one pellet per square foot. Moisture dissolves the pellets, freeing the seed and permitting it to germinate and the grass to grow when climatic conditions are right. Reseeding costs approximately $1.98 per acre.

Grasses are chosen for their suitability to the land. Lehmann's lovegrass, sand dropseed and western wheat were selected for the San Carlos land, and those, plus crested wheat and weeping lovegrass, for the Hopi and Navajo areas.

Reservation Roads

Maintenance of the roads which are essential to the economy, health, education and welfare of Indians resident on the reservations was stressed during this year. There was some work on access roads which had made a valuable contribution to the war effort by providing a way of bringing out timber, oil and rare minerals.

The Indian road system had suffered much deterioration due to lack of funds and equipment to maintain it in wartime. It is estimated that even if sufficient funds become available it will require several years to bring the roads back to a reasonable state of repair. The major part of postwar road work on Indian reservations will be reconstruction of important roads which are beyond ordinary repair, and the heavy maintenance needed to make the whole system serviceable. There are nearly 20,000 miles of roads and trails on the reservations.

During the past year extreme flood conditions caused much damage to roads in various locations.

Construction

The physical plant of the Indian Service, exclusive of irrigation works, roads and sidewalks, is valued at approximately $60,000,000, representing buildings of all kinds, utility services and communication facilities. The present-day replacement value of the physical plant probably would be about $120,000,000.

Since the end of hostilities, as during the war years, no major construction work has been undertaken, only urgent maintenance work to keep the existing plant in reasonable operation being done. As the result there is a large backlog of needed construction, consisting of education, medical and general administration buildings, water, sewer, heating, electric and telephone facilities, and a large amount of urgent maintenance.

Indian Arts and Crafts

Indian crafts products suffered a diminution in quantity and quality during the war years because many craftsmen were in the armed forces or in war work, and because of the shortages in leather, beads, silver, wools and yarn. Through the efforts of the Indian Arts and Crafts Board, however, special regulations were made to provide materials for craftsmen dependent on such handwork for their livings.

During the past year although craftsmen have been returning to the reservations, resumption of craftwork has been slow both because of a natural tendency of many to relax from the strain of war and because shortages in materials continued. Only driblets of silver reached Indians and Indian traders of the Southwest. Turquoise remained exceedingly scarce.

Nevertheless, the major Indian craft enterprises continued, some with increases, some with reduced production. On the basis of incomplete reports, sales of cooperative Indian enterprises showed a total of $492,525 in 1944 and $353,213 in 1945.

The largest slump was found in sales of Alaska crafts, including those of the Nome skin sewers. The figure was $420,200 in 1944, and $263,582

In 1945. Native crafts in Alaska during the war found a huge market because of the presence of the armed forces and others who were ready buyers. Business now is returning to normal.

Welfare

Continuing its emphasis this year on programs designed to make Indians self-supporting through their own efforts, the Indian Service yet was obliged to make relief grants to families unable to earn their own livelihoods. The problem increased as the armed forces' dependency allotments and wartime employment ceased.

Special welfare aid was given, also. Social service assignments during the year included the placement of a worker on the Colorado River Reservation in Arizona to assist in the colonization program there. Case work service for children as well as adults and participation in planning community projects during the period of adjustment were continued.

A social worker also was assigned to the Missouri Basin survey to plan with families to meet the problems which will arise in moving to new home sites when the old are flooded by the building of dams. These services are to continue during the removal and the period of adjustment to new environments.

Income, such as rentals and royalties, derived by Indians from their trust land is regarded as restricted funds, and is made available to them on application to agency superintendents within certain limitations specified in regulations of the Secretary of the Interior governing expenditure of these "individual Indian moneys." By reason of changed conditions and the progress made by Indians it has been determined that more authority should be delegated to superintendents to act in matters of that kind so that this phase of Indian administration may be handled more expeditiously. As the result of a study conducted by the Indian Service, consideration is being given to modification of both the general and special regulations as applied to certain jurisdictions.

The task of maintaining law and order on the reservations continued to be an important phase of Indian administration. It was made the more difficult by a sizeable turnover of Indian police and judges because of the low salaries paid. Salaries range from $600 to $1,200 a year for Indian police and from $180 to $360 for judges. Maintenance of law and order bears directly on the progress made by Indian people.

On May 31, 1946, a law was adopted conferring upon the State of North Dakota jurisdiction over offenses committed by or against Indians on the Devils Lake Reservation in that State. Similar legislation as applied to the reservations in Kansas previously had been enacted. Consideration is being given to the possibility of general legislation to confer such jurisdiction upon States if the Indians of any reservation vote to accept it.

Considerable interest in legislation of this character is being manifested by Indians in various parts of the country, but particularly in Wisconsin, Minnesota, and California.

Tribal Government

Considerable progress in self-government was made during the year by Indian tribes, many of which have government bodies under the Indian Reorganization Act of 1934, the Oklahoma Indian Welfare Act, the Alaska Act, and otherwise. Returning veterans already have become members and officers of some tribal councils.

A total of 181 tribes or bands accepted the Indian Reorganization Act within the 2 years after its passage, 77 tribes rejected it, and 14 other elegible groups did not vote on it. Of the 181 who accepted the act, 92 tribes, bands, or Indian communities have adopted constitutions under the act. In Oklahoma 18 tribes have organized pursuant to the Oklahoma Indian Welfare Act.

Groups with constitutions under the Indian Reorganization Act are entitled to charters issued by the Secretary of the Interior. These charters contain provisions that, after given periods of time, certain specified administrative powers reserved by the charters to the Secretary may be terminated upon vote of the members. Most of the periods are for 10 years, some for 5. The 5-year period in 11 charters has expired, and the 10-year period expired in one instance this year. Others will expire in the fiscal year of 1947. During the 1946 fiscal year one tribal governing body proposed to submit to a vote the question of terminating the powers mentioned, but the proposal was premature since the charter had not been in effect the required 10 years at that date. A survey of the agencies having jurisdiction over the tribes indicated that in many cases only modification of the secretarial supervision was desired.

During the year the Nisqually Indian Community in Washington drafted a constitution. An election has been called to permit a vote as to its acceptance.

Several tribes during the year found it advisable to amend their constitutions and bylaws. The Walker River Paiute Tribe, for instance, adopted an amendment authorizing the tribal council to regulate domestic relations among tribal members and to administer law and order by establishing a reservation court. Other groups which made amendments were the Blackfeet and Southern Ute tribes and the Gila River-Maricopa Indian Community.

Many of the tribes which rejected the Indian Reorganization Act found themselves in need of acting as organized units. The Indian Office has encouraged adoption of constitutions or other organization to provide for a representative governing body. During the year constitutional committees of the Nez Perce Tribe in Idaho and the Sisseton-Wahpeton Sioux ribe in South Dakota drafted new constitutions. Nez Perce Tribe mem- rs rejected theirs, and the other tribe had not yet held an election.

A total of 133 tribes have been incorporated under the Indian Reorgan- ation Act, the Oklahoma Indian Welfare Act, and the Alaska Act. The alt River Pima-Maricopa Indian Community and the Havasupai Tribe ave requested charters of incorporation during the year. In Alaska, 48 ative villages have completed organization under the Alaska Act, which xtended the Indian Reorganization Act to Alaska. During the year the illages of Deering and Point Lay adopted constitutions and charters. he villages of Kojuk, Napakiak, and Shungnak drafted constitutions where- pon charters were issued. Elections have been called to determine hether they should be adopted.

Veterans Participate

War veterans have taken an active interest in tribal affairs. All the fficers of the Crow Creek Tribal Council and the secretary of the Pine Ridge Tribal Council, both in South Dakota, are veterans of World War II.

For the first time in the history of the Osage Tribe in Oklahoma, the privilege of voting by mail in the tribal election was granted to all qualified voters, although in 1942 persons in the armed forces were so privileged. A large number of absentee votes was reported as having been cast in the June 3, 1946, election.

Indian Claims Commission

This year the prospect was bright for the establishment of an Indian Claims Commission to hear and determine the many unsettled Indian tribal claims against the United States. Legislation for that purpose has been sought for more than a decade by the Office of Indian Affairs and the Department of the Interior.

Those claims, based upon alleged treaty violations and other causes, had accumulated over a period of 4 score years. The situation was caused by a law passed in 1863 when various tribes were engaged in hostilities against the United States. The law barred Indians from suing in the Court of Claims. Since then, no claim could be brought without special act of Congress. The discrimination caused a deep-seated sense of grievance. The procedure made long delay. Many Indian groups never had their day in court.

A bill (H. R. 4497) to create a three-man Indian Claims Commission was being considered by the Congress. All claims existing prior to approval of the bill would be heard and determined within 10 years by the commission, which would then cease to exist. Claims must be field within 5 years or be outlawed. Indian tribes, bands or groups could file new claims in the Court of Claims. Claims previously before the Court of

Claims would be determined by that court. The findings of the Indian Claims Commission would be reported to the Congress which would appropriate moneys to pay any final determinations.[3]

Old Indian Claim Paid

By an act approved June 28, 1946, the Congress authorized appropriation of $400,000 "in full and final settlement of the claims of the Indians of Fort Berthold Indian Reservation in North Dakota." The Arickaree, Gros Ventre, and Mandan Indians of that reservation had sought recovery of the money for more than 10 years.

The claim arose from circumstances subsequent to a treaty those tribes made July 27, 1866, with the United States. The treaty provided they should receive $20,000 annually for 20 years. The treaty was never ratified, but the money was paid.

In accordance with a law passed in 1920, those tribes prosecuted various claims before the Court of Claims. The court awarded a net judgment of $2,169,168.58, after making various offsets, one of which was the $400,000. The Indians asserted the offset was made erroneously and that its effect was to deprive them of payment for certain land ceded to the Government under the 1866 treaty.

The Office of Indian Affairs and the Department of the Interior favored enactment of the bill to restore the $400,000 to the Indians, taking the position that, because the treaty was not ratified, the Indians had no legal claim, but that they did have a strong moral claim.

Indian Lands in Missouri Basin

The inter-agency plan for the development of the Missouri River Basin blankets the traditional homeland of the Plains tribes. Twenty-one Indian reservations, having a total of 15 million acres, lie within the seven basin States, particularly in North and South Dakota, Montana, and Wyoming.

A number of projects involve the taking of substantial acreages of Indian lands, while others potentially confer substantial benefits in the development of Indian resources. In time all Indian lands and their owners will feel the economic impact of the plan's full realization.

In the fiscal year 1946 the Office of Indian Affairs took initial steps to bring the vital interests of the Indians into the total interagency planning of Basin development. Over-all basin surveys and certain preliminary engineering studies were undertaken. The proposed construction of the Garrison Dam and Reservoir in North Dakota by the Corps of Engineers, United States Army, occupied a good deal of attention during the year.

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[3] The President signed H. R. 4497 on Aug. 13, 1946.

When substantial funds became actually available toward the end of the scal year a special unit, the Missouri River Basin investigations unit, was rganized with responsibility for conducting the necessary surveys and udies of Indian lands in the basin.

Fort Garrison Dam

The Fort Garrison Dam and Reservoir, a multipurpose project on the main stem of the Missouri River, will involve an area of 145,000 acres n the Fort Berthold Indian Reservation, necessitating the removal and ehabilitation of approximately three-fourths of the resident Indian population. During the fiscal year the War Department and the Department of he Interior, through the Corps of Engineers and the Office of Indian Affairs, respectively, conducted numerous conferences as to the method and means of compensating the Indians for their losses. Section 6 of the 1947 Civil Functions Appropriations Act of the War Department, approved May 2, 1946, requires the Secretary of War to select and offer to the Fort Berthold Indians through the Secretary of the Interior substitute lands of comparable quality and sufficient area to compensate them for the lands to be flooded. The offer of lieu lands must be made prior to January 1, 1947.

The execution of this congressional mandate necessitated the initiation of numerous surveys which were being organized at the end of the fiscal year. During the course of the year, however, preliminary investigations and findings were made as to replacement costs of buildings and improvements on the area to be inundated and as to the original cost of Indian Service roads on the reservation. A preliminary engineering study to determine the damage to Indian land owners arising from the inundation of their potentially irrigable lands, and a reconnaissance of the reservation economy and social organization were made also.

The Three Affiliated Tribes of the Fort Berthold Reservation have consistently opposed the construction of the Garrison Dam at the proposed site. In a resolution dated May 25, 1946, the tribal business council offered an alternate site for construction of a dam with a lower storage capacity at a point about 6 miles south of Sanish near the northern boundary of the reservation. The resolution offered that site free of all cost to to the Government.

Possessory Rights in Alaska

A start on the settlement of the aboriginal rights of Alaskan native peoples was made when Harold L. Ickes, then Secretary of the Interior, ruled on claims made by the Indians of Hydaburg, Klawock, and Kake, villages in southeastern Alaska, to exclusive use and occupancy of certain land and water rights. He concluded that the policy of recognizing aboriginal possessory rights, where native possession had been continuous and exclusive, applies in Alaska as it does in the States of the United States.

His order, promulgated July 27, 1945, recognized as valid the claims of the Indians of the three villages to approximately 8 percent of the area claimed. The decision gave them continued use and occupancy of land areas totaling approximately 273,000 acres, together with rocks and islets within 3,000 feet of the shore and including all inlets where the distance from shore to shore is less than 1,000 feet, all streams, and the waters within 500 yards of the mouth of each stream as defined pursuant to the act of April 16, 1934.

Although the exclusive use and occupancy of the remaining area claimed was denied, the decision recognized that within the area claimed respectively by each of the three groups, the members had continued to use existing trails and waterways, and to hunt, fish, trap, and gather natural resources in common with all other citizens, subject to applicable conservation measures. A decision on the areas totaling approximately 2,008,000 acres, including all of Kuiu Island, claimed by the Indians of Kake in common with all other bands of the Tlingit Tribe, was reserved for future determination. Claim to exclusive rights to the use of certain open ocean waters was rejected.

The petitioning natives and also the protestants asked a rehearing, which was held. On the basis of additional evidence, the Secretary on January 11, 1946, ruled that a number of small tracts amounting to not more than 800 acres in the aggregate had been continued to be used and claimed exclusively by the native groups, but that native rights had been extinguished in areas amounting to 1,120 acres, used for canning facilities, with the acquiescence of the natives.

Field work was done during this fiscal year for the purpose of making a report on the claims of other native villages of southeastern Alaska which had petitioned to have their possessory rights determined.

Reservations in Alaska

Toward the close of the fiscal year several villages in Alaska unanimously asked the Commissioner of Indian Affairs and the Secretary of the Interior to establish reservations for them. These villages included Klawock and Kasaan in southeastern Alaska and Northway and Tanacross in the interior.

Fish Trap Sites

The native peoples of Alaska have a vital interest in the commercial fishing regulations, in obtaining fish trap sites, and in protecting their fishing rights in waters off their established reservations.

They were represented at hearings held in February 1946 in Washington, D. C., to consider proposed regulations limiting the number of trap sites to be operated by any one person or corporation and granting preference in the allocation of excess trap sites to residents of Alaska, native and nonnative alike. They plan to participate in hearings to be held in Alaska at some future date to give Alaskans an opportunity to voice their views on those questions.

Waters off Karluk Reservation on Kodiak Island had been closed by the Secretary of the Interior to fishing by others than the natives residing there or to persons authorized by them. Toward the end of the fiscal year suit was filed in Federal Court in Alaska by a group of packing companies contesting the validity of the regulation and seeking to enjoin the Fish and Wildlife Service from enforcing it. The court issued a temporary restraining order. This litigation will be pursued.

Indian Suffrage

The Navajo delegation in Washington last spring stressed the desire of the Indians of Arizona and New Mexico to vote. The legal ban against their right to suffrage in those states has caused many protests from Indians and non-Indians alike during this fiscal year. Veterans of World War II particularly have objected.

Indian citizens almost anywhere else are not refused the vote by reason of the fact that they are Indians. In Arizona, however, the State constitution has been interpreted so as to deny the vote to Indians as being "persons under guardianship." The constitution of New Mexico refuses suffrage to "Indians not taxed."

The Office of Indian Affairs long has taken the stand that suffrage is the right of Indian citizens just as it is of other American citizens.

Indian Liquor Legislation

In May of this year a bill (S. 2159) sponsored by the Office of Indian Affairs and the Department of the Interior, was introduced. It would permit the sale or gift of liquor to Indians outside the Indian reservations. It would do nothing to disturb the law against possession or use of intoxicating beverages on the reservations, where no one, Indian or non-Indian, may possess them legally.

A special Indian liquor law was first passed more than a century ago at the request of the Indians to protect them from the extortion, cupidity and avarice of white traders. Spirituous liquor often was used to debauch the Indians. Other laws followed, for the protection of the Indians.

Conditions have changed greatly since those days. Many Indians have been acculturated to the white man's civilization. Indians feel that the prohibition which singles them out as a racial group is discriminatory and brands them as inferior. Veterans of World War II, who were able to obtain liquor without difficulty while in the armed forces, have made many protests against the existence of the law. Various Indians tribes hav passed resolutions urging that sale of liquor be permitted to Indians of the reservations.

Menominee Swampland

Notification November 21, 1945, to the Secretary of the Interior by the Attorney General that the United States had acquired title to 33,870.2 acres of swampland in trust for the Indians of the Menominee Reservation, Wis., was the final step in settling a land dispute 90 years old.

The United States had established a reservation, including the swampland, for the Menominees by a treaty in 1854. But the State of Wisconsin claimed earlier ownership of the land under the Swampland Act of 1850. Litigation ensued. The State's claim was upheld. Then the Court o Claims decided the United States owed the Indians for the land they did not get. But the Indians, who conduct a sizable lumber industry, preferred the land to the money. So the United States bought the land from the State, paying a certified Treasury check for $1,590,854.50. Now the Government holds the swampland in trust for the Indians.

Sioux Pony Claims

Work proceeded during the year in tracing the heirs of more than 1,000 Sioux Indians who will receive payment for ponies or other personal property taken from their ancestors by military forces in 1876 during the Sioux wars. Toward the close of the year payments were about to be made to the only three living claimants then found, aged Sioux who were young when the soldiers took their ponies. They are: Bear with Black Body, 93 years old, of the Cheyenne River Reservation, and Daniel Grass Rope, 84, and the Reverend Ben Brave, 81, both of the Lower Brule Reservation. Both reservations are in South Dakota.

Payments are being made from a fund of $101,630 provided for the purpose. Because of the time which has elapsed, the task of tracing so many heirs or successors in interest has been a time-consuming one. At the end of the year, however, 47 cases had been received, and cases were being received from the field in increasing numbers.

Payments are supplemental to partial payments made in the decade beginning with 1890 when appropriations made were not sufficient to pay the claims in full. Ponies had been taken by the military from friendly and neutral Indians as well as from the hostiles. Under present law, only those Indians who were not hostile then or their descendants may receive payments now.

War Veterans in the Indian Service

As of June 30, 1946, the Indian Service was employing 1,169 World War II veterans, both Indian and non-Indians, including 1,053 men and 116 women. Of these 841 were employees who had returned from military furlough and 328 were persons who had not been employed by the Indian Service prior to the war.

More than 1,300 persons in the Indian Service entered the armed forces. Twenty-one of the men and three women died in the service of their country. Many were wounded in action. A number won military decorations. Two men survived more than 3 years of imprisonment in Japan, and several were prisoners of war in Germany for shorter periods.

War and the Aleuts

When the island of Attu, far west in the Aleutians, was recaptured by American forces, no trace was found of its 45 native inhabitants or Mr. and Mrs. C. Foster Jones, Indian Service employees. Mrs. Jones taught the children in the village school, and her husband acted as special assistant. He also operated the Weather Bureau station on the island, sending daily reports by radio. It was not until August 1945 that any news of them was received. The Japanese had occupied the island on June 7, 1942.

In July 1945 a representative of the International Red Cross found Mrs. Jones in Totsuka, a small village near Yokohama, where she was held as a civilian prisoner of war, in company with 18 Australian nurses. After the surrender of Japan she was promptly released and flown back to the United States. She arrived in Chicago on September 30, her sixty-sixth birthday.

According to her account, it was not until the Japanese started firing upon the village from the hills that the inhabitants of Attu realized that the invasion had come. One woman was slightly wounded. On the following morning, Mrs. Jones said, her husband was taken away by the guards, and the following day she was told by Aleut friends that he was dead and that they had buried him in the churchyard. Not long afterward she was taken to Japan.

On her return to Washington Mrs. Jones received from the Secretary of the Interior a check for $6,887.54, covering her salary for the time spent in captivity. During her absence she and her husband received awards of excellence from the Department's Suggestions Committee, along with salary promotions and a war bond. Mrs. Jones retired soon after her return.

In September 1945 a group of the Aleuts from Attu were discovered in Hokkaido. They had been taken to Japan some months after the occupation of Attu and had spent 3 years working in the clay pits. The heavy labor, lack of food and medicine, and the dust of the pits combined to bring about the death of more than half of them. When they were discovered only 23 of the original 45 remained alive. Thirteen died of tuberculosis. Several children born during their stay in Japan failed to survive.

After the return to the United States two of the older people were hospitalized for tuberculosis at the Tacoma Indian Hospital. The Aleuts landed in San Francisco in November 1945 and were met by Indian Servic social workers and representatives of the Red Cross. After a brief sta in Seattle, they went on to Alaska. Because the group was now too sma to maintain a community on Attu, they decided to make their homes o Atka, where many had friends and relatives. Sixteen persons final reached their destination on Atka. Five children stayed at the Eklutn Vocational School, Alaska.

War Relocation Authority

DILLON S. MYER, *Director*

DURING the fiscal year 1946 all efforts of the War Relocation Authority were pointed toward the goal of orderly and final liquidation of the program. In this 1 year 60,000 persons, more than in all the 3 preceding years, went out of the centers to establish themselves in new homes. During the fall of 1945, 8 of the remaining 9 relocation centers were completely depopulated of evacuee residents. In March 1946 Tule Lake Center closed. In February, the Emergency Refugee Shelter, which had housed 982 refugees from Europe since August of 1944, closed after the great majority of the refugees had been permitted to enter the United States as quota immigrants. By May 15 the last of the relocation offices which had been established to help evacuees with their resettlement problems were discontinued and the few remaining problems were turned over to local resettlement committees. On June 30, the Authority, by Executive Order No. 9742, came to its official end.

Resettlement

Many acts of terrorism were perpetrated during the spring of 1945 toward the evacuees who were returning to the west coast. After the press of the Nation became cognizant of these racist activities and launched vigorous editorials condemning them, and after the people had become aware of the record of the Nisei soldiers, such incidents became increasingly infrequent. The last recorded incident occurred on January 29, 1946. Some of the persons responsible for these terroristic acts were brought to trial and punished. A series of public addresses throughout the West Coast States in the fall by five Caucasian Army officers who had fought with Nisei in both the European and Pacific theaters helped immeasurably toward an understanding of the Japanese-American group. The speaking tours were arranged through the Army Speakers Bureau and the officers went to west coast communities where opposition had been particularly vehement.

The growing appreciation of the Nisei soldiers which arose from this speaking program and from the continued publicity about the service of the Japanese American servicemen, reached a fitting culmination when Gen. Joseph W. Stilwell, Commander of the United States Tenth Army, flew across the country to Talbert, Calif., and on December 8 presented Mary Masuda with the Distinguished Service Cross posthumously awarded to her brother, Staff Sgt. Kazuo Masuda. This dramatic event received Nation-wide notice. A few months later, the first Congressional Medal of Honor awarded to a Nisei soldier was presented to the parents of Private First Class Sadao S. Munemori.

Although acts of terrorism markedly decreased, there still existed various types of discrimination against the evacuees who returned to the west coast. These were in the form of restrictive covenants, escheat proceedings, restrictions on business and fishing licenses, and various types of economic boycotts.

Several major steps were taken, on the other hand, which erased much of the discrimination against Japanese Americans on a national scale. During most of the war period Nisei had been required to undergo an investigation prior to taking any civil service position, the delay involved often jeopardizing the appointment. On September 14 this requirement was lifted. Citizens of Japanese ancestry, although serving creditably in the Army, had been barred from the Navy and the Marine Corps. These bars were also lifted in November and Nisei have been accepted in these services. Many Federal restrictions against Japanese alien residents have also been removed, such as the necessity of reporting changes of address and employment, carrying registration cards, and having their bank accounts and other assets blocked. Contraband articles have been returned to their owners. These changes in the status of the evacuated people mark a noteworthy advance since the end of the last fiscal year.

This betterment of the position of the 109,300 people who had departed from the isolated and institutionalized life of the relocation centers improved the opportunities for adjustment in the communities in which they resettled. These communities are in 47 States, Hawaii, and Alaska. Of the total, approximately 57,000 returned to the 3 West Coast States, 52,000 relocated in the rest of the continental United States, 1,108 went to Hawaii, and 82 to Alaska. Many of the 25,788 young men of Japanese ancestry who were inducted into the armed forces have by now been discharged and have joined their families. About 13,000 of these boys were from the mainland—2,355 having been inducted directly from the relocation centers—and the remainder from Hawaii.

The one State in which no evacuees have resettled with assistance from the Authority is South Carolina. Illinois has the heaviest concentration with 11,200. Colorado and Utah are next with about 5,000 each, and Ohio, Idaho, Michigan, New York, New Jersey, and Minnesota have numbers ranging from nearly 4,000 to 1,700. Some 5,600 people who had been settled in other parts of the United States returned to the west coast with the assistance of the Authority after the lifting of the exclusion orders. Many of these were young people who had left the centers early and then felt it necessary to join their parents in returning to old homes.

The finding of a home was a problem for the evacuees, as for many people in the United States. It was a particularly crucial one in the war-congested metropolitan areas of California. Evacuees still owning homes there often experienced difficulty in repossessing the premises and terminating leases. For others there was no housing immediately available. Some moved in with friends and relatives, and many went to the more than 100 hostels which were operated by individuals and church groups with furniture borrowed from the Authority. Beginning in August, the Federal Public Housing Authority was able to take some of the evacuees into its regular projects either as members of veterans' families or as persons displaced by the war. Even these measures were not sufficient, however, and the Authority arranged to take over a number of surplus Army barracks and installations which could be remodeled to provide temporarily for the incoming evacuees while they were looking for employment and housing. Ten such projects in the Los Angeles and San Francisco areas were remodeled and supervised by the Federal Public Housing Authority by agreements with the War Relocation Authority.

The greatest problem during the winter and spring of 1946 was to assist people in moving from the temporary installations into permanent homes. The relocation offices, with local groups and agencies cooperating, made an intensive effort and by May 15 all the installations were closed. The people not yet permanently placed went to a project set up in the city of Santa Monica, to an installation in San Francisco remodeled for family living, to a trailer camp in Burbank, and to privately run hostels which had become regular rooming houses. The San Francisco and Burbank installations were prepared with Authority funds and run as regular Federal Public Housing Authority projects. Welfare cases were taken care of by the counties.

The Authority had faced a considerable problem in seeing that proper provision was made for all welfare cases. Throughout the country persons in need were able to secure assistance until June 30 through the program of "aid to enemy aliens and others affected by restrictive governmental action" which was administered through the Social Security Board. However, the Authority had encouraged evacuees in need to return to their counties of residence. Before the evacuation there had been practically no Japanese on relief. As a result of evacuation many were in need of public assistance. All counties in California accepted the responsibility. Los Angeles County had the heaviest load and made several requests for Federal help. The County has, however, assumed the burden and is doing an adequate job. The Authority feels that the continuing needs of these people will be adequately met.

Evacuees have had comparatively little trouble in finding employment. As has been the case since the people began leaving the centers, all who desire to work have been able to obtain jobs. In many areas these jobs are better than those which Japanese Americans were able to find before evacuation. On the west coast, although there is a plenitude of work on farms, as laborers or as domestics, white-collar workers have had a more difficult time. Nisei have been reinstated in most cases in the California State Civil Service system. As a whole, however, the younger Japanese Americans are able to take good advantage of the high educational standards which they have attained.

While the people were pouring out of the centers during the fall of 1945, and up to the time when the area relocation offices closed. these offices were extremely busy with the adjustment problems of the resettlers. But the effort had also been made to help in the organizing of local resettlement committees to provide assistance in such fields as housing, education, welfare, employment, legal aid and general community orientation. There are at least 87 such committees and 222 community agencies which have committed themselves to provide services for the resettlers. In the East and Middle West these committees took form during the fall of 1945, on the west coast during the winter and spring. The active interest which has been generated gives promise that the general welfare and progressive orientation of evacuees settled in their communities will not be neglected.

During the fall of 1945 the main transportation of evacuee property was from the centers to new relocation addresses. After that property was moved out of the Government warehouses on the west coast to the owners. By May 1 all the property under Government supervision was disposed of, with only a residue of less than one percent not having been claimed. Evacuees had suffered considerable loss of property through vandalism, mishandling, damage, and malfeasance. The War Relocation Authority, which handled many inquiries about these losses, recommended that evacuation claims legislation should be enacted by the Congress which would provide the opportunity for the filing and adjudication of claims for losses resulting from the evacuation, of real or personal property or the impairment of assets.

Closing the Centers

On July 13, 1945, a definite schedule for the closing of the relocation centers was announced by the Authority. All centers (except Tule Lake) were set to close at 2-week intervals, the first on October 15, the last on December 15. The population of all the centers on July 1 was 62,703, of which 17,454 were at Tule Lake.

In July there was still a feeling among the center residents that there would be a residue of "unrelocatable" people when the centers closed. On August 1, however, these feelings were effectively dissipated by the announcement that project directors should schedule departures during the last 6 weeks before the closing date. This scheduling was intended primarily to provide for an orderly flow of departures so that facilities would not be overloaded and provisions might be made for housing. On September 4 the last bar to evacuees returning to the west coast was lifted when the Western Defense Command issued a proclamation rescinding all inividual exclusion orders and other restrictions. By the end of August, ver 2,000 persons were leaving the centers each week. During the week nding September 22, over 3,800 left. As the people departed, messhalls nd blocks closed, and more and more services were discontinued. All he people were given individual assistance in formulating their plans, mon-tary assistance for transportation and resettlement grants where needed. None of them left without assurance that at least temporary housing would be available, and welfare help if necessary.

Every center closed on or slightly ahead of schedule. The following are the actual closing dates: Granada, October 15; Minidoka, October 28; Central Utah, October 31; Gila River and Heart Mountain, October 10; Manzanar, November 21; Colorado River, November 28; and Rohwer, November 30. Jerome had already closed on June 30, 1944.

After the centers were vacated, the appointed staffs turned to the job of putting them in stand-by condition to turn over to disposal agencies, preparing final reports, and shipping the center records to Washington for final disposition.

The War Relocation Authority had under its jurisdiction $100,000,000 worth of Government property. By May 26, 1946, all but a very small portion of this had been disposed of. The $35,000,000 of movable assets had been declared surplus and disposed of mainly to the War Assets Administration. The $65,000,000 in fixed assets had been declared to the War Assets Administration which in turn declared them to the departments interested. Two of the centers went to the Farm Credit Administration, Agriculture Department, seven to the General Land Office, Department of the Interior. Minidoka, Heart Mountain, and Tule Lake eventually came under the custody of the Bureau of Reclamation; Colorado River under the Office of Indian Affairs. Jerome had already been turned over to the War Department.

The Authority had always made efforts to document its program as extensively as possible. It was felt that the program was unique and that complete records of all activities would be of value to administrators and students in the future. Reports from everyone who has been in charge of an activity or a program, together with other file and documentary material are deposited in the National Archives. In addition duplicate sets of much of the material is available at the Libraries of the University of California at Berkeley and Los Angeles. The records of the Emergency Refugee Shelter have similarly been prepared and sent to the library at Columbia University. In addition to the archival records, several monographs and special reports have been prepared for public dissemination.

Tule Lake

After the lifting of the mass exclusion orders on January 2, 1945, relocation offices had been set up at Tule Lake and a trickle of people had left for outside communities. Pro-Japan activities and pressures had lessened considerably after the leaders of the "Hoshidan" were sent to internment camps. With the end of the war against Japan on August 15 and the rescinding of the Army's detainee and excludee restrictions on September 4, the people of the center began to take a more realistic approach to the problems of their future. Although bizarre rumors were still circulated by a minority of Tule Lake residents even after V-J Day, the majority of the people definitely wanted to settle in America. On October 18 it was announced that February 1, 1946, would be the closing date for Tule Lake and that all eligibles would have to relocate by then, the Department of Justice accepting responsibility for all restricted persons. Between July 1 and February 1, nearly 12,600 persons left the center. Of these approximately 8,500 resettled, about 4,000 sailed for Japan, and about 100 went to Department of Justice internment camps. Return to Japan was purely voluntary.

While residents were leaving Tule Lake in such numbers, renunciants and others detained by the Department of Justice were stlil uncertain as to their fate. It became evident that the majority had no desire to go to Japan, that their renunciations had been made in moods of bitterness and under extreme pressure. When asked to sign Department of Justice repatriation requests, they registered their protest. The President, the Attorney General, the Secretary of the Interior, and the Director of the War Relocation Authority received a large volume of letters pleading that they not be deported. More than 1,000 joined a mass habeas corpus suit which is still to be heard before the Federal District Court of Northern California. Until December 10 it was thought that the renunciants might all be deported on a categorical basis. However, on that day, following an urgent recommendation from the Secretary of the Interior to the Attorney General, the Department of Justice announced that the renunciants would have an opportunity to ask for and have a hearing before special officers of the Department to show cause why they should not be deported. The Authority agreed to keep Tule Lake open while the hearings took place and to help cleared persons to relocate. Between January 7 and February 6, 3,186 renunciant hearings were held. Of these, 2,780 were given releases to relocate anywhere in the United States—although they did not regain their citizenship, and 406, with 41 family members, went to an internment camp. Sixty of the releases arrived within the last 24 hours before the final train pulled out for Crystal City on March 20. Tule Lake the last center, was then closed.

Legal Developments

During this year a number of discriminatory rulings were being contested by Japanese Americans. One of these was a mandamus action brought against the State Board of Equalization in California for its failure to grant business licenses. The ruling of the Board was subsequently reversed. The city commissioners of Portland, Oreg., have similarly refused to grant business licenses to alien Japanese, but the matter has not been satisfactorily settled as yet. On June 13 the judge of the Superior Court in Los Angeles ruled that the law barring aliens ineligible to citizenship from obtaining commercial fishing licenses was unconstitutional. The escheat case of *Fred Oyama* v. *the State of California* was heard before the Supreme Court of California on June 13 but not decided prior to June 30. The decision in this case, which is based on the constitutionality of the alien land laws, will affect the more than 50 escheat cases which have been brought in California.

A bill that would permit the Attorney General some discretion to allow potentially deportable Japanese aliens to remain in the United States in cases of hardship has been introduced in the House of Representatives. This bill would affect the many families where one of the parents, having entered the United States as a treaty merchant, is now subject to deportation because of the abrogation of the treaty with Japan in 1941. The Immigration and Naturalization Service granted a stay of deportation for these hardship cases early in June, pending a settlement of the legal issues.

Further legislation was also pending with the introduction in the Senate of a bill (S. 2127) which would establish an Evacuation Claims Commission. The bill provides for a Commission under the Secretary of the Interior to consider claims for loss of personal or real property or impairment of assets arising out of the evacuation. The Secretary of the Interior and the national Director of the War Relocation Authority have advocated the adoption of this legislation which has also been urged by many individuals and national organizations.

The Refugee Shelter

During the first 6 months of the fiscal year, the hopes of the refugees at the Emergency Refugee Shelter alternately rose and fell. The desire of the great majority was to be allowed to remain in the United States and not to return to war-torn Europe where homes had been destroyed and families had disappeared. On July 6 the conclusions reached by the House Committee on Immigration and Naturalization after hearings conducted at the shelter were announced. The report recommended that the Departments of State and Justice should make an investigation to determine whether it was practicable to return the refugees immediately to their homelands. If not practicable, the committee recommended that they should be declared illegal entrants by the Attorney General and deportation proceedings undertaken.

Accordingly, between September 12 and 24, a panel composed of representatives of the State and Justice Departments—and the War Relocation Authority by invitation of the other two—undertook to interrogate all the 912 refugees still remaining at the shelter. They were placed in three categories: 32 wished to return to their homelands, 72 desired to seek admission to other countries, and 814 gave reasons for not returning to Europe. The Authority felt that, in view of conditions in Europe and the policy of UNRRA not to force involuntary repatriation, the majority of the refugees should be permitted to remain in the United States. Considerable negotiation over these points took place between the Departments concerned.

The concern of the refugees was ended on December 22 when the President announced that they would be permitted to apply for admission to the United States under the immigration laws.

Between January 7 and 14 the residents were processed by representatives of the Immigration and Naturalization Service, the State Department, and the United States Public Health Service. The first group departed to proceed by bus to Niagara Falls and there enter the United States through the consulate. Representatives of the National Refugee Service and other cooperating private agencies helped the people with their resettlement plans and assumed responsibility for them after they left the shelter gate. Of the 899 aliens at the shelter, 853 were granted entrance to the United States under the quotas of their respective countries and 46 were given temporary permits—19 because they were adjudged inadmissible, 19 while they awaited repatriation, and 8 while they awaited emigration to a country of their choice.

The refugees resettled in 70 communities in 19 States and the District of Columbia, the greatest number centering in New York City. There seemed to be good promise of their quick assimilation, a process aided by their having learned English and experienced something of the life of an American community while they stayed in the shelter.

With the closing of the last field office on May 15, the War Relocation Authority feels that the job which can be done by a Federal agency devoted solely to the interests of this group of people has been accomplished. The people have been returned to normal American communities and started on the road of readjustment and security. The continuing problems of adjusting the American community to the Japanese-Americans and the Japanese-Americans to the community is one which properly falls on the shoulders of private groups and local agencies. Further help by the Federal Government should be given these people on the same basis as it is given to any other residents of the United States. However, there are three main recommendations which the Authority feels should be made, the accomplishment of which would materially aid the future of that segment of the national population called Japanese-American:

(1) Local resettlement committees should be encouraged to work with the evacuees as long as there remains any problem.

(2) The Evacuation Claims Commission bill should be passed so that evacuees may be reimbursed for the losses which they suffered through no fault of their own.

(3) Aliens, such as the Japanese, who have been resident in this country for many years, should be permitted to become naturalized citizens.

Office of the Solicitor

FELIX S. COHEN, *Acting Solicitor*

DURING the war many of the important functions and programs of the Department were of necessity curtailed or held in abeyance. The fiscal year just ended has seen the resumption, and in notable instances the fruition, of a number of these programs.

The Solicitor's Office was called upon during the past year for legal counsel and guidance with respect to novel and complex questions of law and administration affecting an untold variety of activities scattered over half the globe, from the Pribilof Islands of the Bering Sea to the Virgin Islands 1,500 miles off the coast of Florida, and which are to be found in virtually every section of the continental United States and its possessions; activities which range from the settlement of old Indian treaty claims to the control of atomic energy.

The war brought many new responsibilities to the Department, and, as a natural incident thereto, a corresponding increase in the volume, novelty, and complexity of the legal problems which devolved upon the Office of the Solicitor.

During the year and just subsequent to its close, the position of Solicitor had three incumbents. Fowler Harper resigned on September 10, 1945, and after an interim period in which Felix S. Cohen served as Acting Solicitor, Warner W. Gardner, whose tenure as Solicitor had been interrupted by war service, resumed the position after his discharge as a major in the Army Intelligence Service on October 12, 1945. The resignation of Harold L. Ickes as Secretary on February 15, 1946, necessitated several administrative readjustments pending the appointment of a new Secretary. Mr. Gardner served as Acting Assistant Secretary until June 17, 1946, when he took office as Assistant Secretary, following Senate confirmation. Mr. Cohen served generally as Acting Solicitor from February until the end of the fiscal year.

The ensuing summaries are indicative, briefly, of the legal work coming within the purview of the Office of the Solicitor.

Legislation.—Much of the new legal work of the Department has arisen in connection with legislation recently introduced or enacted, affecting existing functions or authorizing new ones. The Solicitor, through the Legislative Division of his office, is primarily and ultimately responsible for the orderly presentation of the essential facts, as they affect the Department, to the several committees of the Congress, and for careful attention to the many phases incident to the legislative processes. These include, among other things, the preparation of reports to congressional committees and to the Bureau of the Budget with respect to all bills affecting the Department; the attendance and representation of the Department at congressional hearings; the drafting of suggested amendments to bills; the reporting on enrolled bills, including the preparation of suggested veto messages or memoranda of disapproval; and, in a number of instances, the preparation of material forming the basis of statements or testimony to be made by the Secretary or his representatives before congressional committees. The total number of items handled by the Legislative Division increased from 2,698 in 1945 to 4,495 for the fiscal year ended June 30, 1946.

Much of the spade work in connection with legislation is done in the Bureaus which may be especially affected by particular bills. The Solicitor's Office, however, must coordinate these special interests in harmony with the over-all policies of the Department and the purposes of the bill under consideration.

Among the many laws of particular interest to the Department enacted by the Seventy-ninth Congress, a measure of special importance was Public Law 726, establishing an Indian Claims Commission. The Commission is authorized to entertain and adjudicate all hitherto unsettled Indian claims arising from treaty, aboriginal, or other rights which may be asserted by Indian nations or tribes. It provides that all existing claims shall be filed within 5 years from the date of the act or be forever barred, and that claims arising after passage of the act shall fall within the regular jurisdiction of the Court of Claims. Most of the work in connection with the enactment of this law devolved upon the Associate Solicitor and the Legislative Division, in cooperation with the Office of Indian Affairs. Countless hours were spent in the preparation of material and statistics for the information of the Indian Affairs Committees of the Congress, in the redrafting of controversial sections of the bill for committee consideration, in attendance at frequent conferences and committee hearings, in the preparation of reports to the President, through the Bureau of the Budget, indicating the Department's reasons for urging approval by the President, and in disposing of many other highly technical legal questions which arose in the deliberations of the committees or were presented by representatives of the Indians or of other interested agencies. The bill as enacted would seem to be the nearest approximation to a final and just solution of this old and vexatious problem that reasonably could be hoped for.

Another act of first importance to the Department is the Strategic and Critical Materials Stock Piling Act of 1946 (Public Law 520). This act provides for the stock piling by the United States of certain strategic and critical materials required for national defense, for the regulation of quantities and qualities to be stock piled, and for the release of stock-pile material in a manner so as not to affect adversely industry or the general welfare and economy of the Nation. The Secretary's representative served on a special interdepartmental committee instituted by the Director of the Office of War Mobilization and Reconversion to draft a bill which would be satisfactory to the President. The Chief of the Legislative Division and a member of his staff participated in numerous conferences with representatives of the Army and Navy Munitions Board, representing the armed services, the Bureau of the Budget, the Office of War Mobilization and Reconversion, and the Treasury Department in the preparation of the preliminary and final drafts of the bill as eventually introduced.

The Mineral Leasing Act of 1920 was amended in several important respects (Public Law 696); for example, a flat 12½ percent royalty on wildcat leases was prescribed and the limitations upon acreage holdings and options were liberalized. The legal work in connection with the consideration of these amendments involved the preparation of reports, attendance at numerous congressional hearings, and participation in conferences with members of Congress, and required months of time and attention on the part of several lawyers in the immediate Office of the Solicitor. Considable work was also done by the lawyers of the General Land Office and of the Geological Survey.

The approach of July 4, 1946, the date set by the Philippine Independence Act of 1934 for the withdrawal of United States sovereignty over the Philippines, brought a number of intricate legal problems from the Office of the United States High Commissioner. Some of them, although foreseen as inevitably accompanying so unusual a transaction in international affairs, were complicated by the war and by the very recent cessation of the military activities designed to utilize the Philippines as the staging area for the invasion of Japan. Other problems were created by the war itself and by the vast destruction that it wrought throughout the islands. The Solicitor was called upon for opinions, among others, concerning the authority of the Commonwealth legislature to continue to function de facto, notwithstanding the expiration of the terms of some members; on the validity of the payment of prewar debts by Japanese fiat money during the period of enemy occupation; and determining the effect of the withdrawal of United States sovereignty on the title to property in the islands held by the Federal Government. Changes in conditions brought about by the war necessitated legislation to mitigate hardships that would otherwise seriously handicap the independent Republic of the Philippines at its birth. The Solicitor's Office assisted and advised the High Commissioner in connection with legislation authorizing a special election for a President and Vice President of the Commonwealth (Public Law 258); to compensate for war damage and otherwise assist in the rehabilitation of the Philippines (Public Law 370); to define trade relations between the Republic of the Philippines and the United States (Public Law 371); to authorize the naturalization of Filipinos as United States citizens (Public Law 483); and to permit the United States to continue to hold title to most of its property in the islands during the 4-year period of rehabilitation (Public Law 485). The Solicitor's Office participated, finally, in the preparation of the Proclamation of Philippine Independence, issued by the President of the United States on July 4, 1946.

Public Lands.—Defense of the interests of the United States in litigation occupied much of the time of the Public Lands Division of the Solicitor's Office. Three cases involving railroad grant lands were handled before the Court of Appeals, and the Division assisted the Department of Justice in obtaining a writ of certiorari from the United States Supreme Court to review adverse decisions in two of the cases. The antitrust suits brought against the borax combine were satisfactorily settled by the entering of a consent decree providing for the dismissal by the United States Borax Co. of its suit against the Secretary to obtain patent to a tract believed to contain millions of dollars worth of sodium borate. The Department of Justice was assisted in the suit brought by the United States to determine ownership of the submerged coastal lands in California and also in the preparation of legislative reports and statements relative to proposed tidelands oil legislation. Substantial legal service was also rendered by the Public Lands Division and the Legal Division of the Geological Survey in two cases involving the authority of the Secretary to fix minimum valuations on oil and gas for the purpose of computing Government royalties and title of the United States to a section of rich oil land in the Elk Basin field. The Solicitor's Office also participated in litigation involving the control by the Secretary of submerged lands of critical importance in the Alaska fisheries.

The complex ramifications of conflicting claims to a tract of oil land in Kern County, Calif., were unraveled in a solicitor's opinion which recommended the institution of a suit to confirm the Government's ownership and to compensate the Government for past extraction of oil. Basic revisions were suggested in national park concession contracts. Plans looking toward the reorganization of functions in the Department, and delegations of authority from the Secretary to various Bureau heads, were prepared or reviewed. The Office of the Chief Counsel of the General Land Office undertook the legal work in connection with the activities of the newly established Surplus Property Division of the General Land Office, including the preparation of regulations implementing the procedure governing the disposal of surplus real property; and it played an active role in the preparations incident to the merging of the General Land Office and the Grazing Service into the Bureau of Land Management and the transfer to the Department of the Interior of the function of disposing of mineral deposits in certain of the acquired lands held by the Departnent of Agriculture. An attorney was placed in the field with the O. and C. Administration at Portland, Oreg., to assist that office in the wide variety of legal matters with which it is constantly confronted, including the problems arising in connection with the initiation of hearings in connection with the establishment of sustained yield units on O. and C. lands.

During the fiscal year the Public Lands Division reviewed more than 27,000 items and prepared more than 730 items.

A substantial amount of legal work was performed by the Office of the Chief Counsel of the Geological Survey in the consummation of 24 new unit agreements, most of which were designed to promote the search for and the development of new oil and gas reserves in wildcat areas. Sixty-nine unit agreements were terminated during the year. This left 131 approved plans covering 1,722,022 acres of public domain lands outstanding as of June 30, 1946. Thirty legal opinions were rendered on subjects affecting the Geological Survey during the year; 38 accident cases involving Geological Survey motor vehicles were adjudicated; and 8 applications for patent based upon inventions made by Survey employees were initiated and processed pursuant to Departmental Orders Nos. 1763 and 1871 for submission to the Department of Justice.

The Chief Counsel's Office of the Grazing Service disposed of many matters, including the preparation of rules and regulations and orders affecting the administration of the Federal range; the preparation of contracts and cooperative agreements with individuals, livestock associations, State cooperative grazing districts, and Federal and State agencies; the codifying of rules and regulations of the Grazing Service for publication in the Code of Federal Regulations; assisting in the preparation of departmental and Executive orders of withdrawals or modifications of withdrawals affecting grazing districts; commenting on and transmitting appeals from examiners' decisions on grazing applications; and reviewing cases involving contributions under Section 9 of the Taylor Grazing Act for range improvement and other beneficial purposes. Under the Reorganization Act of 1946, the Grazing Service has been transferred to the Bureau of Land Management.

Property Acquisition.—The Property Acquisition Division of the Solicitor's Office participated in the preparation of contracts for the purchase of properties and has performed the necessary legal work to effect the acquisitions required for the helium program, synthetic liquid fuels program, mineral exploration projects, and oil shale plants and laboratories. The validity of the titles to more than 128,012 acres of land acquired by the Government under the Forest Exchange Act and the Taylor Grazing Act was also passed upon, and the consolidation of Indian land holdings, the acquisition of homes for Indians, and the acquisition and exchange of lands for Indian tribes involved considerable legal work. Thousands of acres of donated land were accepted by the Government for national parks upon approval of the titles by the Property Acquisition Division.

Mineral development.—Many, if not all, of the known deposits of strategic and critical minerals were seriously depleted by the war. The necessity of restoring supplies to a level adequate to meet the requirements of national defense and industry is a problem of first importance and the special responsibility of this Department.

The development of atomic energy immediately posed the question of how to control fissionable material. The Department succeeded in its efforts to have the Congress include in the bill for the control of atomic energy (Public Law 585) certain provisions to accomplish this end. In addition to the work done on stock-pile and mineral-leasing legislation, many hours were consumed in writing reports, preparing statistics, and attending hearings with respect to several bills for scientific research and development, all of which vitally affected several agencies of the Department. No bill, for this purpose, has as yet passed the Congress but similar legislation will doubtless be introduced in the next Congress.

During the year 117 invention reports, including 16 originating in the synthetic liquid fuels program, were processed by the patent attorneys of the Mines Division of the Office of the Solicitor. Including the cases mentioned above, action by the Division was taken in 232 patent cases. There are pending in the Patent Office 107 patent applications, of which 71 have been assigned to the Government. The synthetic liquid fuels program has required the processing of numerous contracts for construction of facilities and purchase of equipment, the most important of these contracts being one for the construction of a coal hydrogenation demonstration plant at Louisiana, Mo., at an estimated cost of more than 6 million dollars. Assistance has been given the Bureau of Mines in securing construction authorizations and preference ratings and in meeting other problems arising under Civilian Production Administration controls. The Division has processed approximately 300 contract matters during the year, including those relating to synthetic liquid fuels. Other contracts include the purchase of supplies, the sale of helium, cooperative agreements, and exploratory drilling. It also has reviewed, revised, and codified numerous regulations relating to Bureau of Mines activities, has prepared or reviewed proposed municipal, State, and Federal Safety legislation, and has prepared reports upon legislative matters affecting the Bureau of Mines.

The Department has also pioneered in the drafting of legislation to develop a national fertilizer policy and program, utilizing existing plants in the West and the T. V. A. plant at Mobile, Ala. The plans call for the comprehensive development of processes and methods, consistently with sound conservation policies, for the economic use of our vast potash and potassium reserves on the public domain; the establishment of farm demonstration programs; the prevention of monopolistic control of this industry of such vital importance to our agricultural communities; and the eventual operation by farm cooperatives of the Government-sponsored plants.

Territories.—With the termination of the war, renewed consideration was given to the question of statehood for Hawaii and Alaska and a hange in the political status of Puerto Rico, and assistance was rendered o congressional committees in the consideration of legislation looking to hese ends. The Solicitor's Office was called upon to render legal assistance to the Government of Puerto Rico in a series of cases challenging the onstitutionality of the insular agricultural development, transportation, communication, and land acquisition programs. Except for the communications case, which had not gone to trial at the close of the fiscal year and in which a preliminary injunction was still outstanding, the constitutionality of the Puerto Rican social legislation was upheld, in each of these critical cases, notwithstanding initial adverse decisions.

In addition to the preparation of many bills and reports affecting the territories and insular possessions, the legislative activities of the Division ncluded the consideration of four bills, passed over the votes of the Governors of those islands by the local legislatures. Acting on recommendations of the Secretary, the President upheld the veto by the Governor of Puerto Rico of a bill providing for an insular poll to determine the Puerto Ricans' choice for Governor and permitted a wage and hour law amendment of the municipal council of St. Thomas and St. John, Virgin Islands, to become law without his signature.

After a series of meetings with Department, Territorial and industry officials, bills were drafted for the Governor of Alaska to be introduced by him in the Territorial legislature at the coming session, to regulate trap fishing and also to tax the incomes of businesses and corporation.

Other activities included the controversy over ownership of the mark and name Government House Rum which continues between the Virgin Islands Company and the former distributor; protest before the Maritime Commission against proposals by steamship companies to revise upward their freight and passenger rates; proceedings in behalf of the Territorial areas before the Civil Aeronautics Board for certificates to fly to and across those areas; the draft of regulations to govern the disposal of surplus property; and many other legal problems involved in the governing of our territorial and insular possessions.

Reclamation and power.—With the cessation of hostilities, the Bureau of Reclamation reverted to its role of a peacetime agency of the Department of the Interior. The Congress has authorized an enlarged program for the coming years to catch up with the accumulation of construction work which during the war years was held to a minimum. This backlog of construction work brought with it a vast number of legal problems. The answers to some of these problems have been found; others need further exploration and study.

To aid in the reorganization and decentralization of Bureau activities, the Secretary, pursuant to the provisions contained in the act of December 19, 1941 (55 Stat. 842), supplemented the existing delegations of authority to the Commissioner of Reclamation. Some of these powers and duties were in turn redelegated to certain officers of the Bureau of Reclamation. Within certain limitations these redelegations contained authority and established procedures to be followed in connection with appraisals and acquisitions of land, interests in lands, and water rights, and related matters involved in the construction or operation and maintenance of projects under the act of June 17, 1902 (32 Stat. 388), and acts amendatory thereof or supplementary thereto. Early in January of this year, the Secretary amended Departmental Order No. 2018 so as to authorize the Commissioner to approve and execute any contract for construction, repair, supplies, services and equipment, or any change order thereto, where the amount does ont exceed $500,000. The necessary survey in regard to existing delegations of authority and the drafting of the delegations of authority from the Secretary to the Commissioner, together with the redelegations to various officers of the Bureau of Reclamation, has required one attorney to devote approximately all his time to this work.

Attention was given to matters pertaining to advertising, bids, awards, and execution of contracts for the purchase of supplies and equipment and for construction of project works. The number of construction and supply contracts executed during the fiscal year 1946 reflected the increased work load of the Bureau.

The contract for building the Kortes Dam and power plant on the North Platte River is of particular importance because it is first of many contracts that will be necessary in the construction of the work proposed in the Missouri River Basin.

Some of the more important matters relating to contracts receiving legal consideration were: A claim for increased compensation under the contract for construction of Shasta Dam; the termination of the contract for the Crooked River crossing on the Deschutes project, because of default in performance by the contractor; and the negotiation of a new contract for completion of this work.

Numerous administrative findings on contractor's appeals from contracting officer's findings of fact likewise were rendered by the Conservation Division of the Solicitor's Office. An outstanding example of the latter was the case of the Union Paving Co. of California, which involved 29 separate claims against the Department for additional compensation and the remission of liquidated damages.

A power contract which involved protracted negotiation and a large volume of work was the contract for the sale and delivery of Boulder electric energy to the Arizona Power Authority for resale in the State of Arizona.

Of outstanding importance to the Department was the opinion of September 10, 1945 (M. 33473 Supp.), prepared by the Conservation Division of the Solicitor's Office, defining the minimum revenue requirements with espect to project repayment period, rate schedules, and interest bases for he Columbia Basin (Grand Coulee) project.

With the close of the fiscal year 1946, proposed legislation of far-reaching ignificance to Reclamation was pending before the Seventy-ninth Congress. Proposed legislation included House Bills 520, 5124, and 6574. House Bill 520 would "facilitate settlement of returning veterans on farms in projects constructed, operated, and maintained by the Bureau of Reclamation." Extensive hearings were held by the House Committee on Irrigation and Reclamation on House Bill 5124, a bill "Relating to the sale of electric power and power privileges under the Reclamation Project Act of 1939." One of the amendments would authorize the Secretary of the Interior, whenever opportunities arise in connection with Federal reclamation projects, to improve conditions for fish and wildlife and to provide recreational facilities on a nonreimbursable basis. The Solicitor of the Department, the Commissioner of Reclamation, the Director of the Fish and Wildlife Service, and the Associate Director of the National Park Service appeared before the Committee.

Laws in the enactment of which the immediate Office of the Solicitor as well as Bureau attorneys participated included, among others:

The act of July 14, 1945 (Public Law 143, 79th Cong., 1st sess.), to authorize the Secretary of the Interior to execute a contract between the United States and the Truckee-Carson irrigation district.

An amendment (act of March 6, 1946, 60 Stat. 36), to section 9 of the Boulder Canyon Project Act (45 Stat. 1057) which renewed and extended to veterans a preference in connection with the opening to homestead entry of public lands watered from the Gila Canal in Arizona and the All-American Canal in California.

The act of June 25, 1946 (Public Law 440, 79th Cong., 2d sess.), which amended the act of September 27, 1944 (58 Stat. 747), entitled "An act to allow credit in connection with certain homestead entries for military or naval service rendered during World War II." This amendment extended the benefits of the original act to persons under the age of 21 years who were otherwise qualified.

The War Department Civil Functions Appropriation Act, 1947, approved May 2, 1946. On May 3, the President issued a statement saying he was "glad to note that the Congress, by the addition of certain provisos to the item for the Kings River project, California, has afforded an opportunity for assuring that the Federal reclamation policy, including repayment and the wide distribution of benefits, will apply to that project."

The approval by the Congress of an interstate compact between the States of Colorado and New Mexico with respect to the waters of the Costilla Creek (act of June 11, 1946, Public Law 408, 79th Cong., 2d sess.).

The Flood Control Act of 1946 (Public Law 526) and the Rivers an Harbors Act of 1946 (Public Law 525), are also of outstanding importanc not only to the Bureau but in the activities of the whole Department.

The Bureau of Reclamation's authority on the Colorado River wa broadened by the act of June 28, 1946 (Public Law 469, 79th Cong., 2 sess.).

The Department participated with the Department of Justice in th handling of a number of important cases. Among these were the case entitled, *United States* v. *Maclay, et al.*, and *United States* v. *Buckhouse* two suits for the condemnation of property needed in connection wit Big Flat Unit, Missoula Valley project, Montana; *Northern Pacific Railroad Company* v. *United States,* litigation continued throughout the yea which required the drafting of the Government's brief, proposed findings and a supporting statement of the facts. Counsel of the Bureau als participated in oral arguments in this case. A report was prepared recommending settlement of the long-pending Boise River flood water suit *Pioneer Irrigation District* v. *American Ditch Association.* Bureau counse also participated in the action, *Robins* v. *City of Rapid City, et al.*, ar original proceeding under the Declaratory Judgments Act in the Suprem Court of South Dakota. This was a proceeding for a declaratory judgment involving questions of law alone and concerned the validity of a repayment contract entered into July 27, 1942, among the United States, the Rapid Valley water conservancy district, and Rapid City, S. Dak.

The Bureau's chief water rights attorney assisted representatives of the Department of Justice in the hearings conducted before a Commission of the Court of Claims in the action entitled, *Gerlach Live Stock Company* v. *United States,* and the seven related cases.

National Parks.—During the 1946 fiscal year the legal work in connection with the National Park Service involved more than 1,250 matters, including the preparation of legal opinions, correspondence and documents.

The work of the Chief Counsel's Office included the preparation and interpretation of regulations, the preparation and processing of legislation, the drafting and review of agreements, contracts and permits, and the handling of legal phases of land acquisition and water rights. Legal opinions were rendered on a variety of questions. Of interest were those concerning the Service's authority to control airplane landings on private lands in national parks subject to the exclusive jurisdiction of the United States; the power of the States of Wyoming, Montana, and Idaho, to tax Federal employees in Yellowstone National Park; the power of the State of California to require licenses for the sale of liquor on private lands within Yosemite National Park; and the jurisdiction of the United States and the various States with respect to the control of sanitation and health in National Park Service areas.

Fish and Wildlife.—An unprecedented volume of conservation legislation fecting the many varied programs and functions of the Fish and Wildlife ervice required the almost constant consideration in the Solicitor's Office s well as by the Chief Counsel of that Service throughout the year. Involving far-reaching national as well as international participation by the ish and Wildlife Service in the development and management of valuable shery and other natural resources, these measures presented many novel rafting problems, required the preparation of numerous reports and other material for congressional committees, and attendance at frequent congresonal hearings and departmental and interdepartmental discussions. Of articular interest because of its establishment of a clear national policy nd program for the coordination of wildlife conservation problems was House Bill 6097 (Public Law 732). Again the authorization contained n the act for the rehabilitation of the Philippine Islands with respect to evelopment and rehabilitation of the fishery resources of that country place further emphasis on the already important role that the United States s playing in the development and protection of international and national ishery resources. An international agreement covering the conservation f the fisheries of the Great Lakes finally was signed by Canada and the United States during April 1946. The intensified production of fish during he war years required careful consideration of revised regulations to offet marked decreases in these resources. Again for a second year somewhat drastic revision of the migratory waterfowl regulations was necessary to offset a market decrease in waterfowl populations. Numerous appeals to he Secretary from the decisions of the Area Coordinator of the Office of he Coordinator of Fisheries were disposed of through the Solicitor's Office.

Indian Affairs.—Noteworthy, among many other important and complex Indian cases was the Phelps Dodge Corporation's settlement with the San Carlos irrigation project. During the war the War Department had entered an order of taking permitting the Phelps Dodge Corporation to take such water from the San Carlos irrigation project as would permit the company to operate its mines at Morenci, Ariz., at full capacity. This taking gave rise to a claim against the United States and the company. Towards the close of 1945, the Phelps Dodge Corporation offered to pay $275,000 in settlement of this claim, and the offer was accepted. The district and the Indians will share equally in the distribution of the fund.

In the field of legislation, the outstanding event was the enactment of the Indian Claims Commission Act (Public Law 726), Seventy-ninth Congress, August 13, 1946, bringing to a successful conclusion the effort of the Department over a long period of years to secure the establishment of an agency to investigate and settle the claims of Indian tribes against the United States which hitherto could be adjudicated only when a tribe secured a special jurisdictional act conferring jurisdiction on the Court of Claims. Equally important, perhaps, was the passage of legislation to simplify the administration of Indian affairs by permitting the Secretary to delegate to the Commissioner of Indian Affairs his functions under laws governing Indian affairs, and further permitting the Commissioner to subdelegate to his more responsible subordinates. The issuance of regulations may not, however, be delegated by the Secretary. A notable achievement in the field of irrigation was the enactment of legislation making adjustments of irrigation charges on the Crow Indian irrigation project, Montana (Public Law 468, 79th Cong., June 28, 1946).

Advisory opinions were rendered on two particularly difficult and complex questions, i. e., on the extent of the rights of the Colville and Spokane Indians in the Columbia River Reservoir under the act of June 29, 1940 (54 Stat. 703, M. 3426, December 29, 1945), and on the ownership of the minerals and other natural resources of the Hopi Executive Order Indian Reservation (M. 33821, June 11, 1946).

Counsel at Large, Alaska.—In addition to routine matters, the counsel at large participated in the settlement of disputes under contracts for drilling and exploring for the Bureau of Mines; the preparation of various matters in connection with conflicts over native possessions; hearings in Washington with respect to trap-site allocation and limitation; obtaining the return to the Alaska Railroad of property turned over to the military authorities, in procuring the transfer of certain Army property; the renewal of labor agreements; the lease and sale of floating equipment acquired from the Army; and many other unusual and varied activities.

Solid Fuels Administration for War.—To keep pace with the changing conditions resulting from victory in Europe, victory in Japan and transition from a wartime to a peacetime economy, the legal work incident to the Solid Fuels Administration for War involved the drafting of regulations, orders, exceptions and directions necessary to effectuate the Administration's policy to relax and eliminate its controls over the distribution of bituminous coal, anthracite and other solid fuel, as quickly as conditions warranted. The shortage of bituminous coal because of the strike in April and May and distribution difficulties occasioned by labor disputes and other causes in the several transportation fields, necessitated a departure from the Administration's plan to liquidate, and new regulations and directions had to be formulated and drafted. Opinions were rendered to the Administration in the matters of its regulatory functions and policy, and interpretations were prepared for issuance to the industry generally. The Legal Division of the Administration continued to supervise the organization and functioning of industry advisory groups and furnished such groups with legal advice with respect to their duties, as called upon. It handled all legal problems in connection with compliance proceedings brought to enforce regulations, and cooperated with the Department of Justice in the criminal prosecution of flagrant violations of the Adminstration's regulations. It also handled legal matters growing out of the Government's seizure of mines in 1944 and 1945, and cooperated with the Department of Justice in assembling evidence for the defense of litigation instituted against the Government for alleged damages occasioned by the Government's operation of coal mines during that period. With the breakdown of negotiations between the United Mine Workers and the bituminous coal operators in May of 1946, the Division drafted the initial orders and other documents incident to the 1946 Government seizure, and participated actively in the contract negotiations between the Secretary and the United Mine Workers, and otherwise cooperated with the Legal Division of the Coal Mines Administration.

War Relocation Authority.—After the closing of its 10 evacuee centers, the activities of the War Relocation Authority were terminated on June 30, 1946. During the preceding fiscal year the Solicitor's Office assisted in the program which succeeded in effecting the orderly return of center residents to normal communities. In the course of this relocation process numerous problems of Federal and State relations arose in connection with laws relating to welfare, unemployment and compensation insurance, and the enforcement of civil rights. Considerable legal assistance also was provided in the handling of surplus property and of disposal of land previously occupied by the several centers, and in aiding center residents in their arrangements to resume control of the homes, property, and enterprises they had left behind at the time of evacuation. Claims involving the rights of 93 evacuees of Japanese ancestry to damages for the loss of thousands of dollars in personal property resulting from a fire at a relocation center were decided in favor of the claimants in an opinion of the Solicitor (M. 34436) promulgated shortly after the close of the fiscal year. Eleven of the claims could not be certified to the Congress for payment since they were for amounts in excess of the statutory limitation (42 Stat. 1066, 31 U. S. C. sec. 215) of $1,000. These doubtless will be up for consideration in the next Congress in the form of bills for private relief, since they are not cognizable under the Federal Tort Claims Act of 1946 (Public Law 601), having accrued prior to January 1, 1945.

Other functions.—Three important pieces of legislation, applicable generally to all Government agencies, and which required much time in study and analysis on the part of the Department's lawyers were the Administrative Procedure Act (Public Law 404), the Employment Act (Public Law 304), and the Legislative Reorganization Act (Public Law 601). Title IV of the latter act, The Federal Tort Claims Act, which in substance makes the Federal Government liable in certain tort actions as though it were a private individual, it is anticipated will result in a great volume of new legal work in this field because of the far flung and varied nature of the Department's activities throughout the continental United States and island possessions, and for the further reason that it opens up an entirely new field of recovery against the United States—damages on account of personal injury caused by the negligence of United States employees. The full implications of the legislation are being studied by attorneys in the Legislative and Conservation Divisions of the Solicitor's immediate office.

The Conservation Division completed compilation of secretarial orders and the resulting manual contains a headnote reference to every numbered order issued by the Secretary, beginning with No. 1 on January 27, 1925, and ending with No. 2208 on June 5, 1946.

The Division answered many questions involving the interpretation of contract provisions, for the Department as a whole, and passed on all claims for damage to private property resulting from the acts of Federal employees, the volume of which continued to increase. Many questions on fiscal law were answered involving the interpretation or construction of appropriation laws directly affecting the Interior Department, and numerous problems varying in degree of complexity in the personnel field answered, formally, and informally, including questions affecting leave differentials; eligibility for employment of retired commissioned officers; involving separation; hours of labor for wage board employees; questions involving the retirement laws; use of Government automobiles; leave allowance, including lump-sum terminal leave act provisions; transportation and transfer allowances, Secretarial authority to employ aircraft for travel purposes, payment of travel expenses of a Presidential appointee transferred within the Department and transfer and removal of families and household goods at Government expense.

Division of Territories and Island Possessions

EDWIN G. ARNOLD, *Director*

* * *

IN FULFILLING its comprehensive responsibility for guiding the territorial areas of the United States toward eventual self-government, the Division faced new duties and problems, as well as intensified and expanded functions during this first fiscal year following the end of hostilities. From an international standpoint the work of the Division increased tremendously in importance. With the close of the war the attention of the world was focused through the United Nations on the administration of non-self-governing areas.

The peoples of the four territorial areas—Alaska, Hawaii, Puerto Rico, and the Virgin Islands—with the encouragement and assistance of the Division, accelerated their progress toward self-government despite hardships and deprivations which were the inevitable aftermath of war.

In his annual message to the Congress on January 14, 1946, the President said:

> I urge * * * that the Congress promptly accede to the wishes of the people of Hawaii that the Territory be admitted to statehood in our Union, and that similar action be taken with respect to Alaska as soon as it is certain that this is the desire of the people of that great Territory.

Political advances.—The most significant political advance affecting Alaska during the year was the enunciation by the Department of a policy favoring statehood for the Territory. This announcement supplemented the action of the territorial legislature in providing for a referendum on statehood by the voters of Alaska. During the year, the House Committee on Territories made an extended trip to Alaska and arranged, in cooperation with the Division, an investigation of the general political, governmental and economic structure of the Territory. The committee submitted a report sympathetic to the aspirations and needs of Alaska, but reserved comment on statehood or other proposed changes in the structure of the territorial government pending the outcome of the forthcoming plebiscite on statehood.

On December 22, 1945, the Secretary of the Interior issued a statement favoring statehood for Hawaii. "Self-government," he said, "is the right of all peoples, and statehood is the framework of self-government most appropriate to Hawaii's economic and social situation." A congressional subcommittee held hearings in Hawaii in January 1946, on the subject of statehood. The Division and the territorial government facilitated the work of the subcommittee by arranging an itinerary of hearings on the principal islands at which testimony on all aspects of Hawaiian life was presented, and at which witnesses gave arguments for and against statehood. The subcommittee unanimously found that Hawaii meets the requirements for statehood and recommended that legislation to that end be given immediate consideration.

Acting on the Division's plan and request during the past year to encourage progress toward statehood for Hawaii, the Congress made available funds providing for the establishment of a new Pacific Branch within the Division to assist Hawaii in Washington and to take care of matters relating to the Equatorial Islands now under the jurisdiction of the Department of the Interior.

Prior to this, in October of 1945, the President had recommended that since the existing form of government in Puerto Rico seemed unsatisfactory to a large number of its inhabitants, Congress should enact legislation to submit various alternatives to the Puerto Rican people, in order to ascertain what the people themselves desire most for their political future. The President asked the Congress to authorize for the island a plebiscite to indicate preference among the following forms of political status: (1) The right of the Puerto Ricans to elect their own Governor with a wider measure of local self-government, (2) statehood, (3) complete independence, and (4) a dominion form of government.

On May 17, 1946, the inauguration of William H. Hastie, dean of the Law School of Howard University, as Governor of the Virgin Islands, marked the appointment for the first time of a Negro as Governor for a territorial area predominantly Negro in population. At the same time the Secretary of the Interior announced his full support of the desire of the Virgin Islands people to be represented in Congress by a resident commissioner. The Division drafted a bill to be offered to the Congress that would provide for a resident commissioner in Congress, the Virgin Islands now being the only organized area under this Department's jurisdiction which has no representative in Congress.

Reinforcing these steps toward increased self-government for the Virgin Islands, an Organic Act reform committee drafted recommendations for improvement in the Organic Act of the islands. The Organic Act of the Virgin Islands, passed in 1936 and the most recent of the Organic Acts, has been demonstrated to be short of ideal in several respects. The Division urged the creation of the Organic Act reform committee to make recommendations for corrective Federal legislation, and the committee is now at work in the islands.

Economic improvement.—The promotion of maximum self-sufficiency for the territories, a major responsibility of the Division linked inextricably to progress toward autonomy, was complicated during the past year by economic problems made more acute by wartime rigors and the task of restoring peacetime balance to the territorial economies.

In this connection the aiding and encouraging of the development of territorial natural resources—the initiating of new industries, the increase in agricultural improvements, and the planning and direction of the areas' tourist activities—were Division responsibilities that received priority attention at the close of the war.

Role of transportation in Alaskan life.—Postwar development in Alaska has been greatly hindered by a series of shipping uncertainties, the first being a request by the operators of commercial vessels to increase the already extremely high shipping rates by approximately 100 percent. This request for higher rates has been followed by longshore and other maritime labor disputes, all delaying or stopping shipments of goods to the Territory.

The effects of extended shipping tie-ups are as detrimental to Alaska's economy as a general railroad tie-up would be to the economy of the United States. They have resulted in shortages of food, clothing, and housing, and in economic stagnation. Many mining and other commercial operations, curtailed during the war period, have been prevented from reopening. Altogether they have caused great economic loss, hardship and suffering, and have set far behind anticipated postwar development.

In spite of these difficulties the Territory of Alaska continued to attract increasing numbers of settlers—veterans wishing to establish new homes, industrialists cognizant of the potentialities of new enterprises, others seeking opportunities in mining, fishing, or agriculture. The Alaska housing shortage became correspondingly more severe, with the Territory sharing in the general widespread shortage of building materials and construction labor.

Since large-scale building projects, colonization activities and development plans generally would be dependent for their success in large measure on the availability of transportation adequate in volume, quality, and cost, the Division devoted considerable time and energy to securing improved air and surface facilities.

By the end of the fiscal year, a complete rehabilitation program for the Alaska Railroad was already under way. The program is designed to put the railroad property in first class operating condition by improving the roadbed, roadway structure, and shop facilities, and by the addition of up-to-date motive power and rolling stock. The railroad, never completed to standard during its construction period, was operating before the war largely with out-of-date locomotives and train equipment. The further demand of traffic during the war period left the railroad in such shape that a rehabilitation program was imperative if adequate and saf service were to be maintained and abnormal maintenance expenses wer to be avoided. Preliminary negotiations by the Division to secure al surplus property possible for the improvement of the railroad were completed by the end of the year.

The Alaska Highway, the Canadian portion of which was turned ove to the Canadian Government on April 3, 1946, remained closed to unrestricted pleasure traffic because service and stop-over facilities fo travelers were lacking. The Alaskan portion of the highway was opene to all traffic, without restrictions, before the end of the fiscal year. Th Alaska Road Commission continued the maintenance of this section o the route throughout the year at the request of the Army; but plans wer completed for future maintenance of the road as a civilian operation an as a part of the central Alaskan road system.

Together with improvement in these existing facilities, advancement o plans for the construction of important new roads during the fiscal yea forecasts increased land settlement and intensified mining operations especially in the Kenai Peninsula and the Forty Mile section of Alaska To add to the generally improved transportation picture, new commercia transportation services, begun during the fiscal year, include bus lines o the Alaska Highway, making it possible to travel from the States by lan on common carriers for the first time in history.

Alaska development projects.—During the year, the Division has bee working toward the formulation of an over-all plan for the general advancement of all phases of Alaskan life, with sufficient flexibility to allow fo the Territory's constant development. Industrialists and other businessme in increasing numbers became interested in Alaska's potentialities.

Postwar economy of Hawaii.—As an active base for United State military operations during the entire war, the strain unavoidably place on the economic life of Hawaii made the task of restoring the Island' economic balance one of unusual magnitude.

On the credit side of Hawaii's ledger, the end of the war saw the partia resumption of private shipping between the west coast and Hawaii; commercial air transportation facilities were also restored, and private hotel used by the military during the wartime period were returned to privat operation. The Division promoted and participated in negotiations t increase air service to and from the Islands.

The severe labor shortage in Hawaii, more serious than ever after th end of the war, was partially relieved by the return of veterans, by th termination of some war projects and by the authorization of the importation of 6,000 laborers from the Philippines.

The produce of Hawaii's two main industries, sugar and pineapple, wa redirected from military channels to commercial trade.

As Hawaii's housing situation constantly grew more acute, every effort was made to turn back to the Hawaiian people as much territorial and private land as possible. In answer to the Insular Government's plea, the Division urged the Army and Navy to release land held by them for the construction of dwellings. In the absence of building materials, however, efforts were made to convert to civilian use untenanted barracks and dormitories of military installations.

Scarcity of housing facilities, of certain food items and of agricultural products temporarily discouraged Hawaii's tourist industry, but it is anticipated that Hawaiian tourism will receive an unprecedented boost once these essentials again become readily available.

Tidal wave destruction in Hawaii.—Hawaii is still recovering from the destruction and devastation left in the wake of a tidal wave on April 1, 1946, in which 200 lives were lost and property damage amounted to over $24,000,000. More than 80 percent of the damage centered on the island of Hawaii in and around Hilo. A total of 397 homes were completely destroyed, 961 homes partially destroyed, and 1,300 families were made homeless.

Immediate relief was established in Hilo through the joint operation of the Army, the Navy, the Red Cross and territorial officials. Housing and food were provided for the victims in Hilo at the naval air camp. The Governor appointed a food coordinator and established a revolving fund out of which to buy food, the proceeds from the sale to be returned to the fund to replenish it. The Army and Navy furnished and transported food; the Red Cross had charge of the distribution and feeding.

The Division played a major role in efforts to secure rehabilitation aid for the stricken islands. On April 4, 1946, Delegate Farrington introduced a bill into the Congress to provide relief for victims of the tidal wave. The bill was referred to the Committee on Territories, and negotiations between the Division and other agencies were undertaken to effect the necessary financial aid to the devastated areas. As finally reported out by the committee, the bill authorized appropriations of $1,300,000 for use by the Federal Works Administration to make grants toward the repair and reconstruction of public works destroyed or damaged by the tidal wave; $10,000,000 to be expended by the Commissioner of Public Roads for the necessary rehabilitation of roads, highways and bridges, and a fund of $5,000,000 for the Secretary of the Interior's use for loans to repair and rebuild homes and small businesses. This authorizing bill was passed, and appropriations were approved for the $1,300,000 for public works and for $8,000,000 of the $10,000,000 authorized for roads. No appropriation was made toward the loan fund for rehabilitation of homes and small businesses.

Puerto Rico industrial development program.—Despite material shortages, the Puerto Rico industrial development program went steadily forward. A direct mail approach to interest continental firms in establishing industries in Puerto Rico, for instance, produced almost 600 replies expressing interest in the Company's program of assistance, and the Division extended all possible aid to these groups and individuals.

The glass factory kept the rum industry on normal output, in spite of curtailment of production due to shortages of soda-ash, a glass-making ingredient. Since a large share of the insular government's income is derived from internal revenue taxes levied on rum, this was an accomplishment of considerable importance. Following the Division's encouragement of new industries on the island, construction of a clay products plant was nearing completion, and work started on a small shoe factory as the year ended.

Scarcity of textiles again threatened the life of the island's needlework industry, jeopardizing the income of approximately 60,000 of its workers. The industry was saved, however, from almost complete collapse, when the Civilian Production Administration allotted sufficient materials to the Division of Territories and Island Possessions, at its request, and authorized it to give needed priorities to the needlework manufacturers.

With Puerto Rico in a strategic position as an air center for South America, Africa and Europe, the Division promoted and participated in negotiations leading to increased air service to and from the island. The Civil Aeronautics Board approved applications for routes to Puerto Rico by Pan American Airways, Eastern Air Lines, and Chicago and Southern Airlines, and by the end of the year, besides the certificated airlines, 14 lines were operating nonscheduled or charter flights.

The tourist industry and the Virgin Islands.—The government of the Virgin Islands, the islands' new Governor, and Division officials had, by the end of the fiscal year, formulated plans for the development of the tourist industry in the islands in order to have ready an effective program as soon as transportation and housing difficulties eased. Climatically, the islands are ideal for the tourist industry, with only slight seasonal variations in temperature, and with an abundance of excellent beaches. At present, tourist accommodations in the Virgin Islands are limited, but there is opportunity for large expansion. The economic benefit to the islands, when the revived industry does gather impetus, is obvious, although transportation facilities, particularly by water, had not yet returned to normal at the end of the fiscal year.

The Virgin Islands Company.—Consistent with the purpose for which it had been created, The Virgin Islands Company continued to serve as one of the economic mainstays of the islands. The Company, whose activities are directed toward rehabilitation of the islands, stepped up, as far as possible, its production of sugar and rum during this first postwar year.

Virgin Islands local economy.—The islands' economic situation was aggravated by the necessity for paying high prices for imported goods, while island-produced items commanded low prices. Accordingly, methods of increasing home consumption and export of local output were studied.

Steps have been initiated to better the individual economic security of the Virgin Islands people. Legislation to extend the provisions of titles I, V, and X of the Social Security Act to the Virgin Islands was proposed to Congress during the past year.

During the fiscal year, the Congress appropriated $2,360,005 to make possible first steps in the postwar program for the Virgin Islands, consisting of projected construction by the Federal Works Agency of public works, health and sanitation facilities. The allocation was made under provisions of Public Law 510, approved December 20, 1944, authorizing appropriations totaling 10 million dollars. Material and labor shortages delayed actual construction work, but by the end of the year, bids for various projects had been opened.

Specific services.—The Division not only assisted the territories and islands in attaining their political and economic needs and desires, but also assisted in securing the services of other Federal agencies in meeting and solving economic problems rendered more acute by wartime rigors.

Such cooperation with other agencies, for example, resulted in preventing further sky-rocketing of living costs in Alaska. The steamship companies operating to Alaska for the War Shipping Administration during hostilities stated that they could resume operations for their own account only if freight and passenger rates were revised upward. Any increase at all, let alone those of the magnitude proposed by the companies, would have raised the cost of living in Alaska to an impossible level, since that area is largely dependent on imports of essential items.

Such increases would also have jeopardized seriously the Department's industrial development program for Alaska. Because of the objections raised to the increases on the territory's behalf, the Maritime Commission scheduled hearings on the proposed rates, in which the Division participated. The effective date of the new schedule was postponed until evidence of its impact on the territorial economy could be presented following a study of the situation by territorial agents and counsel.

In the performance of countless services such as this, the Division continued to act as a spokesman for territorial interests before government and private groups, and to make certain that geographic distances did not deprive the territorial areas of the benefits to which they were entitled as citizens of the United States.

Hawaii

Soon after the beginning of the fiscal year Hawaii celebrated VJ-day with the rest of the Nation and then began to attempt to return to normal, peacetime living. The great number of soldiers and sailors predominant in the Territory during the years when it was the greatest base in the Pacific began to be reduced, with resulting reduction in installations and bases. Rehabilitation of war-damaged roads, highways and parks was begun under previously laid plans. Restoration of harbor and wharf facilities and territorial airports was under way.

Wartime controls were lifted from time to time during the year, with almost all of the 151 rules issued by the Governor under the wide powers of the Hawaii Defense Act being rescinded.

The territorial office of Civilian Defense was liquidated as of December 31, 1945, and other volunteer workers such as the Red Cross and the USO resumed peacetime pursuits.

Housing shortage acute.—Lack of housing continued to be one of the major problems of the community. With the assistance of the Federal Public Housing Authority, the Territory made substantial progress in meeting the needs, although seriously delayed by unavailability of materials. At the close of the fiscal year the Hawaii Housing Authority had 1,133 applications for housing in projects built or to be soon available, totaling 2,578 units in Honolulu. Reports for the first 6 months of 1946 show that the average of 116 privately financed homes were constructed a month. Every opportunity has been taken by the territorial government to reconvert barracks and dormitories of military installations located on public lands and no longer needed by the armed forces. The Governor has consistently advocated the opening of additional house lots and present plans of the land commissioner call for the developing of 1,201 lots as quickly as possible.

Employment.—Labor shortages in the Territory have been somewhat alleviated by the availability of discharged service personnel and those who have been separated from Army and Navy projects. The United States Employment Service reported, as of the end of June, that unemployment was practically negligible while they carried approximately 5,000 job openings for the Territory as a whole. Hawaii has experienced practically no unemployment in contrast with the mainland generally. This is reflected by a comparison of the number of claims filed for Veterans' Unemployment Compensation. Of the veterans discharged in the fiscal year in Hawaii, only 4.8 percent filed claims on which an average of $53.08 a claim was paid. Fifty-seven and seven-tenths of the veterans discharged nationally filed claims paying an average of $172.

To alleviate the shortage of unskilled agricultural laborers that existed at the beginning of the fiscal year, which had resulted in greatly reduced crops, especially sugar and pineapples, the Governor signed on August 11, 1945, an order permitting the importation of 6,000 Filipino men, the last of whom arrived only 3 days before their homeland became a Republic.

Financial condition.—The financial condition of the Territory is good, partially as a result of the gross compensation and dividends tax. This act was passed by the 1943 legislature at the Governor's suggestion as a stopgap when it appeared that the Territory was facing a large deficit for the next biennium and no agreement could be reached by the legislature as to how additional revenue could be raised. The tax has worked so well that it has been continued in effect. It is believed that it will continue to be an important method of raising revenue.

The legislature of 1943 and 1945 passed two acts, one permitting the transfer of surplus money from the general, revolving, and special funds of the Territory to the sinking fund, and the other appropriating such sinking funds to be used to retire outstanding term and refunding bond issues of the Territory. As a result of these two acts, the outstanding bonds have been reduced from $34,201,000 on June 30, 1942, to $14,737,000 on June 30, 1946. Deducting the sinking funds, as of the two dates, the net bonded indebtedness has been reduced from $23,783,880 to $9,255,499.

It is difficult at this time to make an estimate as to whether or not there will be a large deficit at the end of this biennium, June 30, 1947. At the close of the last legislative session it appeared that there would be a deficit of at least 9 million dollars. However, tax receipts have not fallen off as expected, and it will be impossible to expend a number of the appropriations due to the impossibility of securing material and labor.

Tax collections for the fiscal year indicate that business is still at a wartime level, in fact exceeding it by nearly 3 million dollars. Twenty-six percent of the $42,473,900.63 total collected in taxes by the Territory was gross income and consumption taxes.

Statehood.—Hawaii's drive for statehood made rapid progress during the year. A subcommittee of the Committee on Territories of the House of Representatives spent 15 days in Hawaii in January, conducting exhaustive hearings on all the islands. At the conclusion of the hearings, it issued a report recommending that immediate consideration be given to legislation to admit Hawaii to statehood. The President of the United States and the Secretary of the Interior have both issued statements in support of statehood, and the Governor has formed a committee of representative citizens of the Territory to press the issue.

Military government decision.—A decision of the Supreme Court of the United States relative to the validity of convictions of certain civilians by the military tribunals during the period of martial law (military government) following the outbreak of war vindicated those of Hawaiia's leaders who had protested the encroachment on their constitutional rights.

Seismic wave of April 1.—In April a seismic wave, attributed to an earth disturbance in Alaskan waters, killed 200 persons and rendered 1,300 homeless when it struck the Islands. Damage to public and private property was estimated to be $24,000,000. The waterfront area of Hilo, on the island of Hawaii, was virtually wiped out. The Army, Navy and Red Cross assisted the Territory in relieving suffering of the victims and accelerating reconstruction. The Governor set up a revolving fund from which food and building supplies to meet the emergency were purchased directly from the Army and Navy and distributed through normal wholesale and retail channels. Temporary shelter for the victims, especially in the hard-hit windward Oahu and Hilo areas, was found in abandoned Army and Navy camps. Legislation to provide Federal financial assistance to meet the cost of reconstruction was still under consideration in the Congress at the end of the fiscal year.

Health.—The health of the Territory has been good during 1945–46. There have been no major epidemics, and communicable disease has been at a minimum. Two new hospital units, partially financed by Lanham Act funds, were completed during the year and made available 250 additional hospital beds. A shortage of hospitalization facilities for the treatment of tuberculosis victims exists and the Territory is making every effort to care for 200 known active cases needing, but lacking, hospitalization on the Island of Hawaii.

Education.—Hawaii's school system continued to furnish progressive education to its young people. The field labor program, instituted after the beginning of the war, to assist in maintaining the production of vital sugar and pineapple crops, was abandoned in January, 1946. An all-time low of 30 to 1 in the pupil-classroom-teacher ratio was reached during this school year and the importation of new teachers from the mainland for the coming year will reduce this figure still further.

Surplus property disposal.—The Surplus Property Office of the Department of Interior after a long delay in being set up, began functioning fully during the year and disposition of the vast stocks of Army and Navy surpluses began.

Crime.—The crime rate for Honolulu was comparatively low: 1,204 major crimes per 100,000 population for the year 1945. However, there has been a slight increase in juvenile delinquency.

Kulani project.—Despite delays caused by shortage of equipment, progress was made on the Kulani prison camp project on Hawaii. A road has been completed to the area, 5,000 feet high on the slopes of Mauna Loa. With the heavy road equipment now available, the Governor is investigating the possibilities of extending the road to the summit of the peak, which will result in an added scenic attraction. Extensive work has been done in clearing the dense forest at the camp site and an experimental nursery has been planted containing many varieties of fruit trees, nuts, hardwoods and ornamental shrubs.

Puerto Rico

At the end of the first postwar year, Puerto Rico is in fairly good economic position. The boom in construction and the soldiers' unemployment bonus have both helped prevent a sudden disruption of the island's economy. The resumption of normal shipping has brought the value of exports up to an all-time high of $170,000,000[1] as compared to exports of $116,203,959 in 1944–45 and the 1940–41 wartime law of $87,884,324. According to the Department of Labor, wages are the highest ever paid on the island. However, food prices are correspondingly high, showing an increase of 8 percent for May 1946 as compared with June 1945. While no conclusive figures are available, it is believed that wage increases have not equalled food price increases.

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[1] June 1946 estimated at $12,000,000.

Financial record.—The department of finance estimates total receipts from all sources for the year at $160,906,679.35, or 19.25 percent more than the previous year. Of this sum, general fund collections were estimated at $81,224,576.79. This was $24,000,000 more than the estimate included in the planning board's third 6-year financial program published in February 1946. Rum exports continued to decline and United States internal revenue returns for the year decreased to $33,216,617.54—11.3 percent below last year. Due to the increasing volume of trade between Puerto Rico and foreign countries, customs duties rose to $3,439,000—an increase of 59.95 percent over last year.

Industrial progress.—During the year, the land authority acquired the Cambalache sugar mill. Although the inventory of the first year's operation is not completed, it is estimated that profits will exceed $175,000. The land authority reports that a good start was given to their program of cooperative education among the laborers of proportional profit farms and agregados resettled under title V.

In March 1946 the water resources authority purchased from the Army the floating powerhouse called the "Seapower." This is a self-contained electric power generating plant of high efficiency and with a capacity of 45,000 horsepower of continuous output. It is now being readied for operation and will go into production as soon as its mooring slip is completed.

The Puerto Rico Industrial Development Co. reported increased production in the glass and cement plants. They also reported that a mill for the manufacture of pulp and paperboard was completed and operations started on May 26. Under construction are a clay products plant and a shoe factory, and engineering plans have been submitted for the construction of a textile mill. In January 1946 the Industrial Development Co. began an advertising campaign in the States to interest American capital in Puerto Rico. Over 3,000 inquiries have been received to date, and four continental firms are at the point of inspecting possible factory sites.

Increased production was also reported for the sugar crop which was estimated at 908,246 tons for the year, compared with 886,000 tons for the previous year. Production of tobacco decreased from 400,000 quintals last year, when the crop was overproduced, to an estimated 250,000 quintals for this year.

Agricultural reforms.—In April 1946 the legislature approved an act authorizing the commissioner of agriculture and commerce to determine an insular tobacco production quota, through a referendum of the 23,745 tobacco growers on the island. This referendum was the first of its kind ever held in Puerto Rico. A total of 17,340 of the growers reported to the polls. Of that number, 17,113 voted in favor of the tobacco quota and only 227 against it.

In June 1946 experts in agriculture from various agencies of the Federa and insular Governments attended a meeting sponsored by the Governor and the planning board to discuss and prepare a long-term program to mee the agricultural and land-use problems of the mountain areas of Puerto Rico. Various projects were visited by the group. Papers were presented and discussed covering all aspects of the problems involved. A permanen organization was set up, composed of representatives of the 15 agencies most vitally concerned, to carry out the program agreed on in the meeting

Department of justice expanded.—Another important development of the past year was the reorganization of the department of justice. The department also initiated a reform of the penal sytsem, including penitentiaries. A system of probationary sentences was instituted for first offenders, and a corporation was set up to provide vocational training for prisoners. The department is also setting up an experimental camp to provide agricultural training for 250 picked prisoners.

Labor.—There were no serious labor disputes during the year. The mediation and conciliation service of the department of labor handled 321 situations, involving 231,989 workers. Of these, only 81 were strikes affecting 25,133 workers and 31 were threatened strikes, with 9,707 workers involved. With the exception of the Bakers Association strike in San Juan, which is still pending, all situations were satisfactorily settled.

In October 1945 the department of labor, in cooperation with the war emergency program, instituted a survey of incidence and duration of unemployment and cost of disabling illnesses, the results of which would serve as a basis for the establishment of a social-security program in Puerto Rico. Figures for March 1946 showed 69,000 unemployed out of a total labor group of 652,000. This is comparable with a census report of March 1940 which showed 66,000 unemployed out of a total labor force of 602,000, or a 0.4 percent decrease in unemployment. Due to the seasonal nature of employment in Puerto Rico, it is believed that unemployment figures fluctuate sharply and are probably at their lowest in the month of March.

Public health.—Progress in the field of public health is reflected in the vital statistics of the health department. The past year showed a record low death rate of 14.1 deaths per 1,000 population. The birth rate increased to 42.3 live births per 1,000 population, compared with an average of 39.9 for the years 1940–44. Leading causes of death remained the same—diarrhea and enteritis first, tuberculosis second.

Education.—The University of Puerto Rico was this year included in the accredited list of the Middle States Association of Colleges and Secondary Schools. A social research center for the study of insular social problems was established at the university, and this year also saw the inauguration of the Itinerant Theatre, an extension activity designed to promote culture and to train dramatic art students.

The university has also inaugurated a veteran's service office. Over 5,000 veterans have been approved as eligible for schooling but owing to he lack of facilities only a small portion of them has been enrolled. Total nrollment in all Puerto Rican schools during the school year was 380,095, n increase of 6.88 percent over last year. The work of the department of ducation was handicapped by the delayed appointment of a commissioner. The department operated throughout the year under an acting commisioner.

In March 1946 the office of information—through the Federal Radio Education Committee—started circulation in Continental schools of the ix 15-minute documentary recordings called "This is Puerto Rico." Over 0 sets of the recordings are being rotated, together with a portfolio of naterial which is kept by the teacher. Early reports from the Federal Radio Education Committee indicate that exceptional interest is being taken by schools in these recordings.

The Puerto Rico Handbook 1946 was published during the year and distributed to a wide list. This book was designed to answer any ordinary question concerning the island. In October 1945 the office began the accumulation of a library of documentary photographs which will eventually cover all aspects of life in Puerto Rico. Well-known photographers are being employed to make the photographs and the library at the end of the year consisted of 2,000 pictures. In May 1946 the office started work on a documentary motion picture of Puerto Rico, to be distributed in the States.

Legislation.—The Governor approved 514 bills passed by the Legislature, to continue and enlarge the islands' health program, to provide substantial sums for construction and equipment of medical centers, municipal hospitals and rural health centers, and to make possible slum clearance projects. Money was also appropriated for a training school for nurses' aid and for medical scholarships, and an act was passed authorizing the commissioner of health to contract for the services of outside physicians to fill vacancies in the department of health.

The Puerto Rico planning, urbanizing and zoning board submitted to the Governor and the legislature the third 6-year financial program—for the year 1946–47 to 1951–52. The program calls for total expenditures of $395,785,053, of which $287,220,543 were assigned for current expenditures, $54,925,300 for capital improvements of tax-supported agencies, $47,162,873 for contributions to public enterprises and the rest for service on proposed and existing public debt. Almost all the recommendations for 1946–47 were approved by the Governor and the legislature.

Other important legislation provided for: the establishment of the coffee industry relief commission; the creation of the soil conservation committee; the incorporation and control of cooperative associations; subsidies for coffee growers; authorization for the Governor to acquire airports and/or airport facilities; a continuing appropriation to the Puerto Rico communications authority for radio broadcasting facilities; creation of the insular veterans bureau; and an appropriation to establish three free schools of music.

Alaska

VJ-day, signalizing the end of the second World War, came close upon the beginning of the fiscal year 1946. With the coming of peace, Alaskans looked forward to a great influx of prospective settlers, including many ex-servicemen to whom Alaska appeared to offer opportunities in an undeveloped, sparsely populated part of our country. The Alaska development board, created by the 1945 legislature, was devoting a considerable part of its activity to compiling and issuing informative literature of all kinds in order to make known to prospective comers the conditions that they would actually face in Alaska. The most serious handicap which would confront every one of them and the greatest obstacle to increasing the population of Alaska through its new arrivals was the acute housing shortage, which in many communities made the absorption of newcomers virtually impossible. This shortage likewise inhibited the starting of even small new businesses, since employees coming from the States would have no place to live.

Veterans benefits.—With the war ended, the returning veterans naturally were deemed of first concern. The Federal Veterans' Administration established a regional office in Alaska early in the calendar year 1946. The benefits presumably provided by the various Federal veterans' acts were, in fact, not available to returning Alaskan servicemen. Not a single loan had been made in Alaska to a veteran under the GI bill of rights. The Governor therefore called a special session of the territorial legislature for two primary purposes: Veterans' legislation, and to make additional appropriations for public health measures, especially tuberculosis, which has increasingly become a serious menace in the Territory.

The legislature, convening for 30 days, enacted a veterans' bill which may fairly be considered among the best legislation of its kind as yet passed by any State or Territory. It provided a bonus of $10 a month for every month of service; it provided loans of various characters: Loans up to $2,500 for educational and personal purposes, and up to $10,000 to enable the veteran to acquire or build a home or farm or to initiate or buy a business or other revenue-producing enterprise, such as a fishing boat. (If a veteran elects to take the bonus, he cannot have a loan, unless he repays the bonus.) It was felt that not only would this legislation bring direct, quick and tangible benefits to the veterans themselves, but would greatly aid in stimulating the economy of Alaska. As the veterans repay the loans, the interest and amortization go into a revolving fund. A veteran, after repaying one loan, as for business purposes, may borrow again for further business development, or for building or buying a home. The interest rate is 4 percent on all loans—contrasting with the generally prevailing Alaskan rate of 8 percent.

The special session of the legislature likewise appropriated $250,000 for the care of tuberculosis patients for the ensuing year, a sum which contrasted favorably with the $30,000 annual appropriation made at the regular session 1 year previously. The Territory had meanwhile acquired the former military, 150-bed hospital at Seward which had been declared surplus to the needs of the Army.

Transportation.—The most serious threat to Alaska's economy for a generation came with the call by the War Shipping Administration of a hearing for the purpose of increasing freight and passenger rates on the Alaska carriers. The War Shipping Administration, desirous of turning these ships back to private operation, had been informed by the operators that they would not take them back unless rates were increased approximately 100 percent. Rates to Alaska were already extremely high and had, in the past, been the subject of repeated protests from Alaskans. Alaska's economic lifeline has for years been maritime transportation from Seattle. But Alaskans have had no control whatever of the character of the service or over the rates which, at not infrequent intervals, had been arbitrarily raised. It should also be pointed out that the steamship business, as far as Alaska is concerned, has been a virtual monopoly.

Since the annual steamship bill for Alaska freight and passengers may be estimated in the neighborhood of 8 million dollars, the proposed increase of a like amount would, on the assumption of there being some 20,000 families in Alaska, levy a tax of some $400 per family, and with no collateral benefits whatever. A thorough study, for the first time, was made of the economics of waterborne transportation, and the newly accumulated facts and figures were presented at subsequent hearings. At the same time the Congress, through the House Committee on Merchant Marine and Fisheries, became definitely interested in the problem of Alaska waterborne transportation. The consequence was that at the end of the fiscal year the prospect of a defeat of the proposed rate increases loomed encouragingly, and work and planning continued among the Alaska development board, the steamship operators and a specially appointed subcommittee of the House Committee on Merchant Marine and Fisheries, looking to a permanent solution of the problem.

While substantial and gratifying progress was being made toward a long-range solution of Alaska's transportation difficulties, an immediate transportation crisis, brought about by an intermittent and steadily lengthening series of strikes and work stoppages among the maritime unions and waterfront workers, laid a crippling hand on Alaska. The months of April, May and June, the last 3 months of the fiscal year, are the crucial months in the preparation for Alaska's seasonal industries—mining and fisheries. It is during these months that supplies and materials are borne northward to take care of the season's, which means the year's operations. Delay of cargo at this period means either a serious impairment or a complete closure o the activities dependent upon these supplies. The maritime work stoppage did irreparable damage to Alaska at a time when it was trying to gear itsel to peacetime activities. Gold mining, interior Alaska's great industry which was suspended during the war years and whose resumption wa confidently anticipated, proved to be almost negligible in the first postwar season.

The lack of steamship service also greatly affected the labor supply, since airborne traffic was likewise wholely inadequate. Other industries beside fishing and mining, notably construction (and especially housing)—urgently needed after 5 war years were similarly checked or nipped in the bud. This situation increasingly calls the attention of Alaskans to their dependence on water transportation and the vulnerability of their position in their having no real alternative transportation adequate to their needs.

The prolonged and continuing maritime tie-up further emphasized the steadily increasing importance of air transportation, which to a limited but nevertheless ever-increasing extent, could be counted upon to diminish in some degree the acuteness of the hardships brought about by maritime paralysis. The Department and the Alaska development board had, during the year, taken an active part in the so-called Pacific Case before the Civil Aeronautics Board, which was to determine the routes and carriers from the United States to the Orient. The Department strongly endorsed the report made to the Civil Aeronautics Board by its examiner and public counsel, which recommended a route from Alaska overland to the Middlewest and an additional Alaska carrier to be certificated from Alaska down the coast to Seattle.

Industries.—The tourist industry is the greatest potential field of undeveloped activity in Alaska. The Territory's economy is and has been woefully lopsided, having consisted for the last half century of only mining and fisheries, the former almost wholly gold, the latter chiefly salmon. In every State of the Union and the sister Territory of Hawaii, as well as in other countries, the tourist business has become an increasingly important and expanding economic resource. Alaska's superlative scenery, its matchless sport fishing, its wildlife, the native arts and crafts, all combine to make it ideally suited for tourist development. The big deterrant to an immediate boom in Alaska's business is the lack of adequate transportation and hotel accommodations.

Serious concern has been aroused in recent years over the apparent diminution of Alaska's abundant fisheries and wildlife. While various factors are ascribed to this threat to Alaskan economy, since fisheries are its first resource and furs its third, there is universal agreement upon the inadequacy of appropriations for the necessary enforcement officers. It is literally impossible to police against poachers the fisheries and the wildlife—both under Federal control—with the small staff provided by congressional appropriation. Moreover, further intensive research, for both fisheries and wildlife, is equally required to learn the habits of the species and the causes for variation in the runs, both as to time and size.

The Virgin Islands

Political.—This year, on the tenth anniversary of the present constitution of the Virgin Islands, the Organic Act of June 22, 1936, the people of the Virgin Islands reviewed a noteworthy record of effective local government under universal suffrage and other democratic political institutions established by that Act. Moreover, they looked forward to the continuing evolution of their democratic institutions as justified by this ten-year record and as advocaed by the President this year in his annual message to Congress when he said, "The people of the Virgin Islands should be given an increasing measure of self-government."

Inauguration of new governor.—On the occasion of the inauguration of the fourth civilian Governor, William H. Hastie, on May 17, 1946, Virgin Islanders took pride in the significant fact that their own views had been received, fully considered and given effect by the Senate Committee on Territories in connection with the confirmation of the new Governor. It was also a source of much gratification to the community that the Secretary of the Interior and other ranking representatives of Government from Washington, by their presence in St. Thomas on the occasion of this inauguration, and the President by his special message to the Governor and the people on the same occasion, further demonstrated the national concern with the advancement of the legitimate interests and aspirations of the inhabitants of the outlying possessions of the United States.

Economic.—The economic life of the islands is based on the bunkering activities of the port of St. Thomas, the manufacture of beverage spirits in St. Thomas and St. Croix, and the sugar industry of St. Croix. This year showed a steady improvement in shipping to St. Thomas. A total of 353 ocean going vessels, with gross tonnage of 1,493,725, visited St. Thomas, as compared with 204 vessels with gross tonnage of 264,640 in 1945 and prospects are good for continued improvement. St. Croix' basic industry, sugar, showed a production increase from 4,040 tons in 1945, to 4,970 tons in 1946, due to increased acreage and acre-yield and to improved processing. St. Croix exported 137,608 proof gallons of rum and liqueurs in 1946, as compared with 129,082 proof gallons in 1945. St. Thomas exported 817,441 proof gallons in 1946 as compared with 1,340,208 proof gallons in 1945.

The rum and liquor industry, upon which these islands have depended during the past few years for their major source of revenue and for private employment of wage earners, has suffered a severe curtailment of production during the year because of Federal conservation orders. Still the largest single industry in the islands, rum manufacturers were turning more and more, as the year closed, to the still unrestricted manufacture of whiskies, gins, and liqueurs from neutral spirits for the continental American market.

Public works program.—With appropriations totaling $2,360,005, already made by Congress for the projected construction by the Federal Works Agency of public works, health, and sanitation facilities authorized by Public Law 510, approved December 20, 1944, no major construction project had been started by June 30, 1946. The first bids opened late in the year for sanitation facilities for St. Thomas were rejected, and the projects readvertised. Prospects for an early start of construction of these urgently needed facilities are not bright in view of unsettled conditions in the entire building and construction industry.

Health and sanitation.—The general health of the islands has been good and there were no epidemics, despite the primitive sewage disposal methods for large parts of the community. The legislative assembly adopted a rigorous milk control law to become effective on July 1, 1946, but at the end of the year it appears that strict compliance will not be achieved for several months. Federal public health grants were available for general health training, tuberculosis control, and venereal-disease control. These grants have become a major factor in the development of an aggressive program in the public health field.

Finances.—The revenues of the municipality of St. Thomas and St. John were $1,112,002.07 as compared with $1,257,416.53 in the preceding year. In St. Croix, revenues were $262,257.54 as compared with $515,383.28 a year ago. Congress appropriated $150,000 toward the expenses of local government in the municipality of St. Croix. Financial and economic trends do not indicate any unusual revenue increases in the coming year. Indications are that in the municipality of St. Thomas and St. John, the peak of wartime income has passed and that ways and means must be found to provide the best possible municipal services without further budgetary increases. In St. Croix, Congress has provided for a study of the municipal government by three municipal experts, under the supervision of the Committees of the Senate and House on Appropriations, to formulate a policy as to future assistance from the Federal Government.

Social welfare.—Efforts were concentrated on the securing of improved municipal appropriations for aid to the poor and on the obtaining of Federal aid for supplementary public assistance and welfare services, through the extension to the Virgin Islands of titles I, IV, V, and X of the Social Security Act. This legislative reform has not yet been achieved, although there is no area under the flag where American citizens are in greater need of such assistance from their government.

Education.—The public school program has been maintained with senior and junior high schools, elementary schools, in-service teacher training, scholarship loans, evening schools for adults, limited vocational education, and school lunch and nursery school programs. In St. Thomas and St. John the average annual expenditure for public education per child was $66.50. In St. Croix the cost was $52.40.

Military services.—Throughout the year there has been a constantly accelerating withdrawal of personnel from all military establishments in the Virgin Islands until at the year's end all installations are reduced to essential maintenance personnel. Of approximately 800 Virgin Islanders who were conscripted for military service, 650 had been demobilized and returned to the islands by June 30, 1946. These figures do not include Virgin Islanders who were conscripted in the United States and those who voluntarily enlisted.

Legislatures.—During the year the executive approved a total of 137 bills passed by the municipal council of St. Thomas and St. John, 42 bills passed by the municipal council of St. Croix, and 11 bills passed by the legislative assembly. A total of 11 bills were vetoed. Two bills were repassed over the Governor's veto, one of which, an increase in wages and decrease in working hours, was sent to the President for his decision.

Organic Act revisions.—A committee set up under local legislation submitted to the Governor its report recommending revisions in the Organic Act of 1936. The most significant recommendations included a single legislature for the islands to meet annually in 60-day sessions, the removal of the power of the Governor to send bills passed over his veto to the President for final decision, the creation of a single treasury, and establishment of the office of resident commissioner in Washington. The proposals will be placed before the Congress during the coming year.

Equatorial Islands

Under existing statutes and Executive orders, the Secretary of the Interior is responsible for the government of Baker, Howland, and Jarvis Islands (under United States sovereignty) and Canton and Enderbury Islands (under the joint sovereignty of the United States and Great Britain). Because of their location, these islands are of special importance to the Government of the United States in connection with aviation and meteorology.

The Philippine Islands

As the Philippines were scheduled to receive their independence shortly after the close of the fiscal year, the Division cooperated with Philippine officials in preparing for the withdrawal of United States sovereignty from the islands. The disbursing functions, which the Division had performed at the request of the Philippine Government, ceased and arrangements were made for the transfer of the funds and securities on deposit with banks and with the Treasury Department to the new Republic of the Philippines.

Puerto Rico Reconstruction Administration

EDWIN G. ARNOLD, *Administrator* [1]

OPERATIONS of the Puerto Rico Reconstruction Administration during the fiscal year have been confined principally to protection of investments previously made and to conservation of the most essential features of its former broad program of rural rehabilitation. Its projects have been substantially the same as those for the preceding four years during which activities have been financed exclusively with sums allotted by the President out of the Puerto Rico revolving fund created by the act of February 11, 1936 (49 Stat. 1135), and consisting of income and the proceeds of the disposition of property derived entirely from PRRA's operation of projects which were financed with funds originating in the Emergency Relief Appropriation Act of 1935.

Expenditures on approved projects totalling $1,024,000 (including unobligated balances of $112,700 from the previous fiscal year) were approved by the President, leaving a net balance of approximately $2,927,000 in the revolving fund as of June 30, 1946. From this balance and anticipated accretions to the fund the President has thus far authorized PRRA expenditures for the fiscal year 1947 totaling $776,500.

Rural rehabilitation and housing.—PRRA built 281 rural houses during the fiscal year on 843 acres of formerly unproductive land now devoted to raising subsistence crops to eke out the meagre income of the resettled farm-laborer occupants. From these new houses, the 6,409 rural houses and 1,210 urban family dwelling units previously constructed, and the nominal rentals of some 4,400 small parcels of land without houses, the office of housing management collected $383,700 as against outlays authorized for management and maintenance of $254,300. All of the urban units and 97 percent of the rural homesteads were occupied on June 30, 1946. Under the policy of encouraging tenants to become owners, 356 monthly occupancy agreements in the urban zones and over 5,500 in the rural districts had been converted by June 30, 1946, to liberal discount long-term purchase agreements.

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[1] Appointed by Executive Order No. 9618 of Sept. 19, 1945.

Closely tied to the rural housing developments, the activities of PRRA's seven Central Service farms and PRRA agronomists' free advice and supervision of resettlers' cultivating, harvesting, and marketing practices, resulted in the planting of approximately 14,000 acres of varied subsistence crops and 4,500 acres in cash crops on lands of the Federal Government occupied by PRRA resettlers. The 1,100-acre Castaner farm operated by PRRA to demonstrate that a coffee plantation can be made self-supporting by proper crop diversification, produced $54,506 from sale of citron, coffee, sugarcane, and various minor crops against authorized expenditures of $53,950, while furnishing employment to the members of more than 200 resident families.

Cooperatives.—In the continuation of the long-established program of assisting in the organization, financing, and guidance of cooperatives, PRRA last year gave special attention to those which market agricultural products. Of such, two additional cooperatives were organized with PRRA advances totaling $29,000, and with the five similar vegetable marketing cooperatives previously financed, they had a gross income of approximately $657,000, compared with last year's total of $500,000, despite continued poor marketing conditions and shipping problems. A contract was also made for a $20,000 loan to a Central Cooperative to serve other marketing cooperatives, which received its charter on June 29, 1946.

The Citron Cooperative is now experiencing more difficulties than any other sponsored by the PRRA, having about 700,000 pounds of citron in brine in the process of curing, for which there seems to be no demand, largely because of sugar restrictions. The Puerto Rico Rug Cooperative with better designs and outlets increased its last year's volume of about $122,000 to approximately $345,000. The Resettlers' Rug Cooperative, organized and financed during the fiscal year with a PRRA loan of $44,000, had sales of $38,350 since starting operations late in the spring. With payments respectively of $265,405 and $30,270 including interest, the Sociedad Agricola and the Cotton Growers' Cooperative discharged their PRRA loans in full. Likewise the Lafayette Sugar Mill Cooperative, as a result largely of successful operations in its subsidiary solvents plant the previous year, repaid during the fiscal year 1946 $500,000 of PRRA advances several years in advance of their due date, and on June 30 paid the interest then due on the remaining principal balance of approximately $2,500,000.

The Los Canos Sugar Mill Cooperative likewise paid its amortization installment due June 30. Lafayette, due to the cessation of lend-lease and war contract demands for butyl alcohol and acetone, has not operated its solvents plant during the fiscal year, but has ordered equipment for conversion to the production of industrial alcohol. In its sugar operations, Lafayette ground about 35,000 tons more of cane than the previous year, and led all other mills of the island in "yield." Los Canos, however, ground approximately 50,000 tons less than the previous season, due partly to shortage of fertilizer, unfavorable weather, and affiliation of some colonos with other mills.

Eventual liquidation of PRRA.—Even on the basis of its present limited program, it will be a matter of only a few years until the revolving fund is so depleted that adequate financing cannot be continued. Administrative expense of a still more restricted program would be disproportionate to its accomplishments. How PRRA controlled properties and administration of its projects might be transferred to the insular government, with due regard to the value of the remaining Federal investments and on terms which would assure furtherance of the Federal program's objectives, is the subject of current studies. However, no definite plan is yet ready for submission.

Surplus Property Office[1]

JOHN M. BARRINGER, *Director*

* * *

THE Department of the Interior, on May 10, 1945, was designated by the then Surplus Property Board (now the War Assets Administration) to be the disposal agency for certain war surpluses located in the territories and island possessions. In turn, the Secretary of the Interior, by departmental order, authorized the Division of Territories and Island Possessions to carry out the Department's functions in that respect. For this purpose, the Surplus Property Office was originated, headed by a Director in Washington, with additional offices, each under the direction of a territorial surplus property officer, in San Juan, Puerto Rico; Anchorage, Alaska; and Honolulu, T. H.

The first objective of the Surplus Property Office disposal program was to supply fully the needs of territories and island possessions; the second, to find outside markets for the overflow.

In carrying out its functions, the Surplus Property Office was guided throughout the fiscal year by regulations and policies established by the Surplus Property Board and its successor agencies in accordance with the Surplus Property Act.

Organizing occupied several weeks following the activation of the Office. During that period, field operations were outlined and necessary forms were prepared and printed.

On June 30, 1946, the Surplus Property Office had 425 employees. Of these, 74 were in the Washington office, 104 in Alaska, 177 in Hawaii, and 70 in Puerto Rico.

By the end of the fiscal year, net acquisitions of surplus property turned over to the office by owning agencies totaled $157,470,846.50. This was the original cost of the property to the Government, as declared by the owning agencies. This total included surplus real property amounting to $19,930,925 at reported cost.

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[1] On October 15, 1946, Secretary Krug issued Order No. 2265 recreating the Surplus Property Office as a unit independent of the Division of Territories and Island Possessions.

During the year, the surplus real property in the territories and island possessions was turned over to the General Land Office (now Bureau of Land Management) for disposal.

Sales during the fiscal year ending June 30, 1946, totaled $56,338,281.24 at reported cost to the Government. Realization, or money received and turned in to the United States Treasury, was $17,903,374.45 during the year. Obligations of the Surplus Property Office during that period totaled $1,268,978.73, or 7 percent of the realization on the property sold.

Board on Geographical Names

MEREDITH F. BURRILL, *Director*

* * *

DURING the fiscal year 1946, the Board on Geographical Names made significant progress in extending, clarifying, and rationalizing fundamental policies. Both the Division of Geography and the interdepartmental Advisory Committee that together constitute the Board have contributed to this program, the former through formulating policy statements in the light of current experience and over-all needs; the latter by review in the light of past experience and the special problems of the several agencies represented.

The Board has continued to extend and to elaborate the basic principles upon which its name decisions are based, with particular attention to the application of the names of persons to natural features, and to the names of Antarctica. These policy statements are doubly useful. They aid the Board in impartial and unbiased consideration of controversial cases, and they aid individuals in selecting appropriate names for recommendation to the Board, a matter of particular importance to the explorers of uninhabited regions. The procedures accompanying these policies, providing for explicit areal application of names, should assist materially in rationalizing nomenclatures heretofore often unordered and confused.

The Board during the year developed and adopted an improved form for use in the promulgation of its decisions, which should be of material assistance to map makers and other frequent users of such decisions. The form allows for a more complete statement of the circumstances surrounding the decision which in turn will facilitate an understanding of the bases on which that decision has been rendered.

The Division has counseled with all of the active Federal mapping agencies and has provided special and general aid and information in the solution of name problems as encountered by those agencies. During the year the Division has undertaken the preparation of directions for use by mapping agencies in the treatment of great numbers of geographical names in various areas of the world. Primary emphasis in this program has been on Latin American areas, and a series of such publications with cumulative lists of names approved by Board decisions will be ready for distribution in the next fiscal year.

The Board has continued its examination of the various map languag of the world. With the assistance and cooperation of interested Feder agencies the Board prepared a standard transliteration system for renderi the Arabic alphabet in Latin letters. Continuing study is being given the modifications of the standard Arabic system that are required for t Persian language. The unique file of Mongolian name materials develop by the Division has increased during the year to the point that the Divisio is able to provide standard names for use on maps of Mongolia as require

The master card file of standard names more than doubled in size durin the year. It now contains nearly 3 million names, about half of which hav full cross references from the numerous variant forms to the standar name. Considerable work is still required to incorporate the large numb of cards supplied by other agencies cooperating with the Board. Wit this increasingly valuable resource the Division during the year answere over 6,000 inquiries received from nearly threescore Government offic and from a large number of business firms and individuals. By serving a a ready reference point for the answering of troublesome questions concerning geographical names this operation represented a saving of thousand of dollars to the Government alone.

The Division continued to edit geographical names appearing on th maps and in the texts published by the various Federal agencies, achievin in these instances the consistency of name usage so necessary in the publications of the Government. This editing process is based upon the name contained in the master file and on procedures developed within the Divisio for securing additional names not in the file at the time of editing. Thes new names, processed in the absence of such names in the file, become a par of the file and are thus usable in subsequent editing.

In all these matters the Division of Geography has worked closely witl the Advisory Committee of the Board. The membership of the Advisor Committee on June 30, 1946, consisted of representatives from the following agencies and organizations: Government Printing Office; Library o Congress; State Department; Office of the Chief of Engineers, War Department; Military Intelligence Service, War Department; Post Office Department; Hydrographic Office, Navy Department; Forest Service, Departmen of Agriculture; Bureau of the Census, Commerce Department; Coast an Geodetic Survey, Commerce Department; Geological Survey, Departmen of the Interior; National Archives, the National Geographic Society; American Geographical Society of New York; the Geographic Society of Chicago; and the Geographical Society of Philadelphia.

Heavy demands on the Division's services continued unabated throughout the year following the Japanese surrender, and the rendering of such services proceeded up to the limits of available funds. There is increasing evidence that the needs for technical and scientific geographical name information will be even greater in the future than during the war. Increasng concern of this Nation with other parts of the world has greatly expanded the importance of such information. Although material progress as been made during the war years in filling the wide gaps in this country's vailable knowledge of foreign nomenclatures, much more remains to be done than has been accomplished. The inadequacy of information on the geographical names within our own country must continue to be a source of grave concern, and it is imperative that measures be taken to provide this nformation.

Division of Personnel Supervisio and Management

MRS. J. ATWOOD MAULDING, *Director*

* * *

WITH the end of the war there was naturally an abrupt shift in th labor market and whereas recruitment had previously been difficult i practically all occupational groups there are now an increasingly large number of applicants. This shift is exemplified by the increase in the numbe applying in person to the central personnel office alone from practicall a handful a year ago to over 700 last month. With the release of the me from the armed services our own furloughed employees have been comin back and at the end of the fiscal year approximately 4,500 have returne to the Department. Some others have chosen employment elsewhere There are still around 2,700 who have not been released or have not ye applied for reinstatement. In addition there have been available for placement those in liquidating and contracting war agencies in the Department.

In March a large part of the examining and recruiting work of the Civil Service Commission was transferred to the operating departments by Executive Order 9691 with authority to make employments pending the establishment of registers. Thus the Departments were called upon, on 30 day's notice, to establish machinery for systematic recruitment and certification, with required priorities for veterans and former employees. For the establishment of permanent registers provision was made for the creation of committees of experts to handle examinations for professional and scientific positions peculiar to the Department, and for boards of examiners in the field to meet the needs of the various Bureaus. While in accord with the philosophy of more active participation in the framing and holding of examinations, the Department and the Bureaus have been handicapped by having to undertake this work on short notice without adequate provision for additional personnel. In connection with the recruitment process contacts have been made with the United States Employment Service, veterans' organizations, private and public schools and colleges, professional associations and other Government agencies. In filling vacancies the Department's policy has been to give first consideration to its returning veterans and second to qualified employees affected by liquidation. This has involved considerable placement work across Bureau lines by the central office.

It is interesting to note that in the 5-month period prior to this report the Department entered on duty over 10,000 veterans. This number includes both former Department employees and new veterans. They are now being added to the Department at the rate of about 2,000 per month. Of course, normal turn-over takes place; but the latest record shows that nearly 30 percent of the total personnel of the Department are veterans. On his return the veteran is given his old job back or a better one if it is available and he is qualified for it. While budget and organization restrictions have prevented a higher grade in some cases, we have been able to give higher grade jobs to a substantial number.

During the war employee training came into its own. At one time regarded in some quarters as a luxury, training has now proved its own case as a necessity, not only to bridge the gap between formal schooling and job requirements, but also to inculcate knowledge and foster ability in new activities for which established schools are not yet prepared. In this Department in-service training has seen a noteworthy extension. Of special significance in this connection is the promulgation during the year of a Statement on Training in the Department of the Interior. This was followed by the issuance of A Supervisor's Guide to Employee Training developed by the Training Section in collaboration with outstanding departmental supervisors and designed to assist all practicing and potential supervisors to analyze work loads, identify production and personnel "lag," determine training needs, select appropriate kinds and methods of training, and to call upon bureau or departmental training personnel for advice and counsel in setting up needed programs.

During the year the Department concluded with the Veterans' Administration formal working agreements covering the training of veterans under Public Law 16 (rehabilitation of vocationally handicapped veterans) and Public Law 346 (the so-called GI Bill of Rights). These agreements have been promulgated throughout the Department with instructions for carrying them into effect wherever such training is shown to be in the interest of operations and veterans.

In the departmental training office the following established training projects continue: Shorthand refresher courses; typing refresher courses; secretarial practice classes; orientation on the departmental level; supervisory training program; administrative training program.

In the classification field the retrenchment in war work and the expansion of the postwar program increased the activities. Classification surveys have been made in several of the Bureaus and a total of 210 working days were spent in the field in connection with field-office organizations. A total of 4,567 positions were allocated during the year, 1,368 of which were in the departmental service and 3,181 in the field service.

The Standards and Specifications Section has had its first full year of operation. The coordination of the standards work of the Department with the work of the Civil Service Commission is of first importance and has done much to unify the thinking within the Department in the standards program. All of the jobs in the field service have been coded in accordance with the Commission's Handbook of Occupational Groups and Series of Classes. For those positions which are not defined in the Commission's handbook, this office has established its own code numbers and definitions as a temporary expedient until such time as the Commission completes its survey and amends its handbook.

The basic policies governing wage fixing for employees of the Department as enunciated in Secretarial Order No. 1989 of September 8, 1944, were continued. A total of 33 wage boards, established by the Secretary, functioned during the year for the various Bureaus in the Department. In May and June 1946, public hearings were held by the Southwestern Power Administration Wage Board and by the Bureau of Reclamation Wage Boards for the Columbia Basin project, the Klamath project, the 3 divisions of the Central Valley project, Boulder Canyon and Parker Dam projects, and for the All-American, Gila, and Yuma projects. In addition wage conferences were held by the Bureau Wage Boards at Denver, Boise, and Amarilla for field officials and other interested personnel who were not involved in the public hearings mentioned above. The Division of Personnel Supervision and Management was represented in all of the hearings and conferences and determinations of the wage schedules. Effective June 3, 1946, the Secretary granted authority to the Director of Personnel to approve wage rates and on June 5, 1946, to approve overtime.

All evidence indicates that the morale of the Department's personnel is high. The number of grievances filed have been few and only 31 efficiency rating appeals have been presented for adjudication to our 2 Boards of Review located in Washington and Chicago.

Information regarding recreational opportunities, housing, group insurance, and health hints has been disseminated. Welfare and credit services have been available. The hostess group has been carried on with the assistance of the bureau counselors and personnel officers. Its work has been tied in closely with the Interior Department Recreation Association, the activities of which have been stimulated and enlarged as a result of reorganization and departmental promotion. A series of talks by Bureau heads to our employees regarding the work, function, and scope of each of the Bureaus has been instituted, looking to a better informed personnel.

In line with the long-range program for decentralizing operating responsibility as fast as practicable to the Bureaus, there was delegated to the Geological Survey in September 1945, authority for handling all field personnel actions below grades CAF–11 and P–4. The authority of the Bureau of Reclamation, Bonneville Power Administration, and South-estern Power Administration was also extended to include field positions grades P–6 and CAF–13. The maintenance of retirement records was cently transferred to the Bureaus in Washington. During the year 13,257 tions were processed in the Division, and 35,518 actions by the Bureaus ere post-audited.

At the close of the fiscal year the Department had 51,330 compensated nployees, 4,694 in the metropolitan Washington area and 46,636 in the eld service. In addition there are 1,586 uncompensated personnel.

The staff of the Division has aimed all of its activities toward rendering ater service to the operating Bureaus and acting in an advisory capacity on epartmental personnel policy. It is felt that the staff has increased the easure of good will within the Department, which is a factor toward aintaining high morale.

Departmental Safety Program

FRANK L. AHERN, *Departmental Safety Engineer*

THE OFFICE of the Departmental Safety Engineer was established during the year for the purpose of assisting the different Bureaus of the Department to establish and improve their safety programs and thereby reduce the number of employee accidents and control fire losses in buildings under the jurisdiction of the Department. The Department's program, in addition to employee accident prevention and the protection of public property, includes in some cases, public safety as well.

The Bonneville Power Administration has had a safety program since 1940 and that program is being reviewed to make it more effective.

The Bureau of Mines, internationally known for its work in safety with industry, added a safety engineer to its staff for the purpose of reducing employee injuries and for the protection of public property.

The Bureau of Reclamation, which has also had a safety program since 1937, prepared plans for more intensive work in accident prevention in its field operations.

The National Park Service continued the program which it established in 1937.

The Fish and Wildlife Service has taken steps to obtain authorization for a more intensified program in its Service.

The Departmental Safety Committee, composed of one representative each from the different bureaus of the Department, has produced a new edition of the Motor Vehicle Regulations and Safe Driving Practices for the Operation of Motor Vehicles by Employees on Official Business. These regulations are in accord with the President's program for the reduction of automobile accidents nationally.

The Department is represented on interdepartmental organizations, including the Federal Fire Council and the Federal Interdepartmental Safety Council and on committees of national scope relating to matters of safety standards.

This report is submitted as one of progress. In future reports it is expected that results will be presented that are satisfactory to the Department and in the public interest.

Interior Department Museum

H. L. RAUL, *Museum Curator*

* * *

THE Interior Department Museum has entered upon its ninth year since its dedication. During this period it has continued to visualize to the public the history, aims, and activities of the Department's 97 years of vital services to the Nation. Visitor comments frequently stress the effectiveness of its logical arrangement and selectivity of exhibits, and the supporting information set forth in the descriptive abels and in he material at the information desk which serve to reinforce visitor interest in the activities of the Department.

Attendance and Foreign Visitors

During the past year approximately 48,000 persons visited the museum. Visitors were recorded on the visitors' register from all States in the Union. Registrations were received also from Alaska, Hawaii, and Puerto Rico. Foreign registrations were from Argentina, Australia, Belgium, Bolivia, Brazil, British West Indies, Canada, Chile, China, Costa Rica, Cuba, England, France, Guatemala, Italy, Mexico, New Zealand, Norway, Panama, Peru, Philippine Islands, and Romania.

Victory Exhibit

A retrospective exhibit portraying the Department's participation in the successful prosecution of the war is permanently installed in the foyer of the museum. Installed in case No. 1 is a service flag especially designed in display materials with numerals for 8,092 blue stars and 150 gold stars, signifying the magnificent record of employees who served and those who died while in the armed forces during the war. In cooperation with the Division of Personnel and Management, 2 panels carry the individual names of those who gave their lives. Beneath the service flag and supporting it is mounted an enlarged official seal of the Department signifying the participation of all departmental employees in activities supporting the victorious war effort.

Opposite the service flag which pertains to personnel in the war is place a large display panel consisting of eight sections which carry general information relating to the many essential activities pursued in the war program of the Department in administering the vast resources of the Natio in metals, oil, power, fuel, helium, food, land, water, and timber as wa materials.

Collaboration With Bureaus

A large relief map of the United States, 66 by 33 inches, and a revise topographic map of Washington and vicinity, 54 by 44 inches, both map engraved and printed by the Geological Survey, were installed in th museum. A printed exhibit pertaining to Indians in the war was place on permanent display in the gallery of the Office of Indian Affairs. Thi material lists such data as awards for valor, Indians on Iwo Jima, those wh gave their lives, wounded in action, and Indian Service employees in th war. Numerous display cases throughout the museum have been and ar being revised, in collaboration with the Bureaus, in line with the historica purposes of the retrospective victory exhibit and to reflect current activities

Cooperation With Other Agencies

Cooperation has been given upon request to numerous organizations Museum lecture tour service was extended to representatives from the embassies of allied countries, including Belgium, China, Czechoslovakia Finland, Great Britain, France, Greece, Italy, Netherlands, Norway, Commonwealth of Philippines, Poland, Russia, and Yugoslavia, acquainting the cultural attachés of the various countries with the responsibilities and accomplishments of this Department. A like service was accorded to a group of officers of the Chinese Army working with the General Staff in Washington, who visited the museum particularly to study the exhibits of the Bureau of Reclamation, the Geological Survey, and the National Park Service.

Included also in these extension services were the intern group of the National Institute of Public Affairs, and the national group of 100 high-school teachers attending the Institute on the position of the United States in World Affairs under the auspices of American University. Included among the college groups visiting the museum were the selected students from State Teachers' College, Minot, N. Dak.

Loan Exhibits and Accessions

Among the notable recent accessions is a large oil painting, 72 by 50 inches, depicting the scene in the State Department at 4 a. m., March 30, 1867, on the occasion of the signing of the Alaska Treaty concerning the ırchase of the Territory. The picture is an excellent copy, by Lynn aucett and Helen Wessells, of the original which was painted by Leutze, ıd was placed in the museum by the Division of Territories and Island ossessions. The painting complements the earlier installed museum picıre that illustrates the later flag ceremony in Alaska at the time of the ctual transfer of the Territory on October 18, 1867, at Sitka, the Russian ıpital.

Another new feature in the museum is an unusually large animated iorama showing the harbor and environs of the city of Juneau, Alaska. 'he naturalistic scene and the motion of the shipping and tram cars, and ıe changing effects of illumination from day to night make this diorama ery effective, and of particular and timely interest.

Of great attraction to museum visitors is the recently installed diorama f the central area of Washington, plan of 1939, including the Interior)epartment Building, loaned by the National Capital Park and Planning 'ommission. For convenience in comparison the diorama is accompanied ›y a hand colored map which shows the plan of 1946, covering the same rea.

An exhibit of historic interest, loaned by F. E. Dotson, has been added o the helium exhibit. This is a small container filled with a specimen of ıelium from the United States Navy C–7, first helium-filled airship, Bolling 'ield, 1920.

Among the temporary loan exhibits is an oil painting, 38 by 30 inches, ›f the S. S. *North Star,* famous polar vessel, shown in World War II :amouflage. This Interior Department ship participated in the United States Antarctic Expedition, 1939–40, United States Antarctic Service, in :ooperation with the Division of Territories and Island Possessions, later was commissioned by the United States Navy as a vessel of the United States Coast Guard in 1941, then was returned to the Office of Indian Affairs in 1945, and is now in operation in the Alaskan Service. The picture is on loan from Lt. (jg) M. A. Lee, U. S. C. G. R.

Another special exhibit consists of a collection of 10 books comprising some recent publications relating to Indians, published by the Office of Indian Affairs.

A large sculptured model of the official seal of the Department has been placed at the entrance to the museum.

Orientation Programs

Museum lecture tours have been given throughout the year to all new employees under the orientation program organized by the Division of Personnel and Management. Many comments have been received from individual new employees stressing the value of visualizing their relation to the work of their Bureaus and the manner in which the individual Bureaus fit into the Department as a whole, as displayed in the museum.

School Classes

Numerous school classes and other organizations have visited the museum during the year. Many requests from school teachers for assistance in preparing study programs on subjects relative to the conservation and other departmental activities have been fulfilled.

Inquiries have been handled daily at the information desk and special services rendered whenever requested. The generous cooperation extended during the year by the offices and bureaus afforded much benefit to the museum.

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RECLAMATION ● IRRIGATION ● FUEL ● WATE
● ELECTRIC POWER ● MINERALS ● FOOD
● FISH ● GAME ● GRAZING ● RECR
ALASKA ● HAWAII ● PUERTO RICO ● VIRGIN

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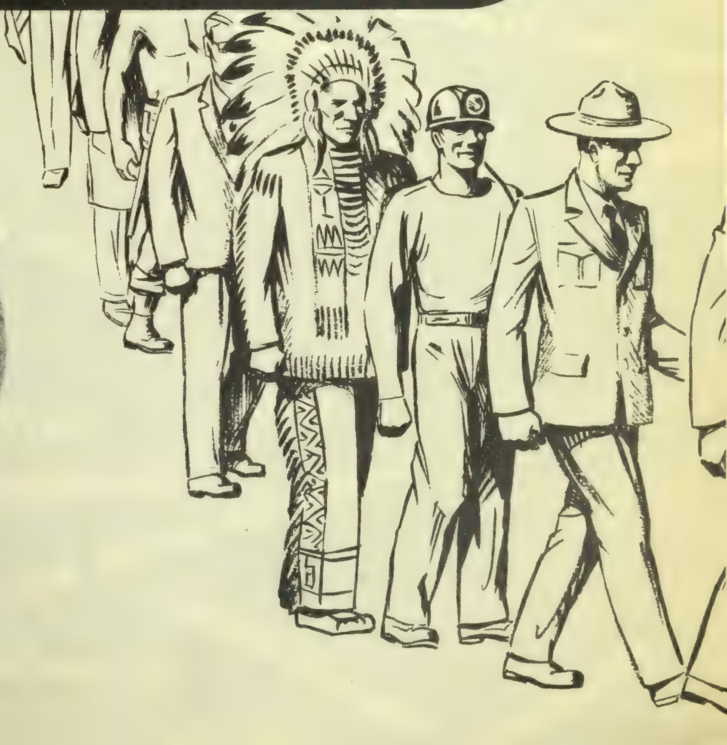
Natural Resource
Programs

Annual Report
the Secretary of the Interior for 1947



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Annual Report of the Secretary of the Interior

Fiscal Year Ended June 30, 1947

UNITED STATES
DEPARTMENT OF THE
INTERIOR

J. A. KRUG, SECRETARY

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THE SECRETARY OF THE INTERIOR
WASHINGTON

My Dear Mr. President: The annual report of the Department of the Interior for the fiscal year ending June 30, 1947, is transmitted herewith.

The report covers the first major period of our transition from war to peace and the impact of domestic and world demands upon the natural resources of our Nation. It highlights the results of the war's wasteful drain on our natural reserves. It poses problems urgently demanding solution, others to be faced in the next few years, and still others of vital interest to our long-range, broad economic welfare and national security. All are the responsibility of the Department of the Interior, shared by the people of the country whom we have diligently sought to serve during the fiscal year.

Sincerely yours,

J A Krug

Secretary of the Interior.

The President,
The White House.

PART I

Natural Resource Programs

Natural Resource Programs

AMERICA MUST PRODUCE AND CONSERVE

SOLUTION of domestic and world problems depends largely on the capacity of the United States to produce at the present high levels required for the needs of an increasing United States population and for the reconstruction of western Europe.

The ruthless urgency of war demonstrated that America's productive capacity is well nigh limitless, given the will, the direction, and the continued incentive of its people. The peace is not merely surcease from war and its needs are no less urgent—it must represent the full flowering of man's desire and ability to enjoy the full and secure life implied in "Democracy." Free people have a demonstrated capacity to consume and to make full, beneficial use of the fruits of technology. This capacity must be matched by wisdom in the production and use of natural resources. The Nation's capacity for growing and making things—its huge industrial plants and its vast agricultural resources—can meet the demands of our people for all the things they require and provide a considerable measure of foreign aid. As this country's reconverted production capacity for peacetime needs is fast outstripping war production levels, the aim is not to readjust our sights to prewar levels, but to keep up with 1947 demands for goods and services and to anticipate decades in advance the requirements of an expanding population for a maximum employment economy with a population of 147,500,000 people in 1950, of 155,000,000 in 1960, and perhaps 165,000,000 in 1990. The Nation must not gage its future merely by looking at its past. Nor can it ignore the magnitude of its past contributions—contributions that assist in a progressive lifting of standards of living and hence an increasing stability for the people of other free nations as well as for its own citizens.

The infancy of our postwar period makes us realize that the requirements of people under a vigorous, free, and modern technology are far greater than ever before conceived. The capacity of the human race for the comforts of life and for its pleasures is the capacity to demand and accept the products of modern technology as rapidly as those are made possible. The demands for housing, for clothing, for food products, for refrigerators and radios, for automobiles and for farm machinery, for entertainment, and for recreation are on a spiralling upward scale. The spirit of true free enterprise in a democratic system is, therefore, best expressed in the capacity to produce better things, more efficiently and abundantly, and to distribute them at prices which make mass consumption possible. That has been America's great contribution to the well-being of the world.

Rapid and unrestricted technological advances in providing comforts and necessities of living must and can be maintained in a free economy. Monopolistic controls of such advances strike at the heart of such an economy, and ultimately serve to disrupt and stifle normal expansion. The principle of willful obsolescence as a method to increase production, sales volume, and hence profits must yield to better quality and longer life of manufactured products. This provides new opportunities for the profitable expenditure of the consumer dollar in an expanding horizon. The ability to produce better things requires an unshackled technology, directed to increasing the useful life of the production unit, and of the useful life of the item produced.

Future goals cannot be achieved in small portions of progress, measured by the restrictive ability of the least able. America's common denominator of progress has never been the least which could be comfortably achieved. All-out production must be efficient if it is to be lasting. Full capacity to produce must embody full ability to utilize human and natural resources without waste. In this urgent combination our past demonstrates a sad profligacy in the use of the available resources. Our soil has been ripped apart and forests have been torn from it on a "cut out and get out" basis. Most mineral resources have been extracted with thought to the greatest profit and not the greatest use. But we are learning. Our extraction processes are now far less wasteful than those of 20 years ago. We are beginning to realize that full production—at levels greater than before—requires the wise and full use of our resources. Without the basic material to manufacture and produce, production capacity—capital, management, and labor—is meaningless.

Conservation means full and wise use—by the application of modern extractive and manufacturing techniques to render value of every shred or drop of what the earth provides—by substituting the inexhaustible for the exhaustible wherever technology can permit it—by avoiding the use of the precious rare for commonplace applications.

Conservation requires inventory. Without knowing the extent and state of our resources, the Nation cannot intelligently and effectively produce on a sustained basis. Productive capacity scheduled on a dwindling resource will become wasted capacity, and the disruption created ultimately may dislocate the entire national economy. Technological programs of substitution must be geared to the imminence of change in the quantity and quality of basic resources. Programs of imports must be intelligently scheduled to provide a continuous, smooth flow of materials for which our domestic supplies may become strained. But without knowing how much we have, and where our resources are, no real plan or program can be ndertaken by either industry or Government.

Conservation means efficient management in the general public interest. It stems from the foresight derived of inventory and the need for full and wise use of what is available. It demands synchronization of private and public effort in the discovery of new material sources, of new technologies in the use of materials and in the development of new productive capacity. It does not mean the application of arbitrarily restrictive practices by either Government or industry—it does mean the formulation of joint and collaborative programs of resources development as well as conservation so as to render greatest use of what we have and to insure the abolition of past wanton exploitation. The Nation planned well for war production; there is no reason why it cannot do so for peace in a system of competitive enterprise.

Conservation requires the expenditure of public funds for the securing of inventory, for exploratory and development programs where private capital cannot assume a long-term burden, and for the execution of large-scale, long-range resources-development public works. It must be recognized freely and frankly that a major portion of conservation activities requires both expenditures and the passage of time beyond the normal financial ability of private enterprise. Although great strides are being made in the husbanding of our resources, we have a long way to go to repair past damage and to move ahead beyond a deficit level. Our soils must be subjected to an ever increasing application of soil and moisture conservation practices. We must rapidly substitute new soil areas for old, tired, and worn ones and we must revitalize and reuse improperly farmed acres. We must sustain the fertility of existing good acres and reestablish that of poor acres by the expanding use of proper farm practices and the application of fertilizer.

Our remaining forests must be cropped on a sustained-yield basis, and devastated forested areas must be reforested. Range lands must be husbanded and properly cared for if we are to supply ourselves with protein-rich meat. The sharp and dangerous deficiencies in our known commercial reserves of industrial minerals call for ingenuity in exploration, in mining practices, and ore treatment. The substitution of more plentiful materials for those that are scarce and the elimination of wasteful and inefficient uses must be integrated with any over-all program of conservation.

The government has demonstrated the wisdom of public expenditures for resource development and conservation activities. Without the great public works projects, the war would have been prolonged interminably. These huge river control and development projects by making possible the irrigation of otherwise unproductive lands, provided millions of tons of needed food. Billions of kilowatt-hours generated as a byproduct from these projects made it possible to manufacture the aluminum and magnesium, ferro-alloys, and important chemicals required by the war machine. Important as these direct contributions were, however, they are but a small indicative portion of the long-term economic gains they have provided. The availability of hydroelectric power within less than a decade from the inception of the Federal power system in the Pacific Northwest made possible the establishment of electroprocess industries having a total plant investment value of $160,000,000. The tax revenues from these industries have already exceeded the $280,000,000 investment in power facilities by the Federal Government and the annual value of their product is averaging $140,000,000. As a measure of what the Federal development of irrigation lands can mean to the national economy, one project alone in the Yakima Valley of Washington has produced $76,000,000 of crops in 1946 and has made it possible to furnish gainful employment for a population of 100,000, where prior to the development, only sagebrush and jackrabbits were found. This project represents an investment of $39,653,360 of which $10,540,895 now has been repaid including $3,449,114 on the Tieton division completely returned on February 14, 1947.

The Federal Government's multiple-purpose water and land development projects in the West currently pay off the original investment of public funds and pay their way. Many project expenditures have been repaid in full; most of them are reimbursing the Treasury at a rate greater than expected or required by law. These new lands and new reservoirs of abundant electrical energy provided in the development of the western country are symbols of America's capacity to produce and are in complete accord with the United States' pioneer tradition of domestic expansion.

It would be an error of tragic consequence to the future of the Nation, however, if Federal expenditures for conservation of natural resources were to be gaged only on a strict, current dollars-and-cents repayment basis. Much of the drastically needed investment for sound programs of conservation will not be returned in kind. Such expenditures represent premium payments for the insurance of America's future, and the well-being of unborn generations. A few dollars spent today for geological surveys may mean the discovery of vital ore, vital perhaps not today but a decade hence. A few dollars spent today in the planning of multiple-purpose projects will probably save countless thousands in their construction years hence. The examples can be multipled dramatically to sustain the thesis that adequate expenditures must be made in economic health and security.

Although conservation is a collaborative undertaking between Government, industry, and agriculture, Government must assume and expand its leadership. National security demands that our natural resources be appraised, utilized, and husbanded in a manner most conducive to long range economic stability and the national defense.

Since conservation assures continued production, Government must accept an increasing responsibility in the planning and functioning of conservation activities.

FOUNDATIONS FOR CONTINUED PRODUCTION

A major portion of the concern of the Federal Government in the resource foundations for continued production—land, water, minerals, and energy—is implemented in the functions of the Department of the Interior. In some fields the Department's activities represent the sum total of the Federal Government's diligence in conservation and resources development, such as in minerals. In other fields other departments of Government share the work in varying degrees. There are important corollary fields in which the Department of the Interior has primary responsibility, including the maintenance of the value of national parks, our fish and wildlife resources, the administration of the affairs and lands of the Indians, and the administrative development and protection of the public domain, exclusive of the national forests.

The Department of the Interior has frequently been considered a department of the West. Although its activities are truly national in scope and application, a large portion is primarily of direct effect in the vast areas of our western country and Alaska, since a major portion of the Nation's untapped and underdeveloped resources are there.

The importance of the western country—and hence of the Department's functions and responsibilities for its full development—is becoming more and more apparent. War years brought a tremendous influx of population to the West, and particularly to the Pacific Coast States. This movement is continuing. Furthermore, and due in large measure to the assistance of the Federal Government, the West's economy is expanding. Its industries have multiplied at a fabulous rate and its agriculture is an increasingly larger proportion of the Nation's total production. However, there are clear indications that population growth is at present outstripping the development of opportunities for gainful employment and that unless programs of resources development, conservation, and capital investment are continued vigorously at an accelerated rate, the situation will become critical. It does not require unusual perspicacity to conclude that western development must be given every encouragement.

This annual report of the Secretary of the Interior relates its stewardship of these resource foundations, of the progress and the problems of its past year. The keynote is somber but with expressed optimism as to possibilities for remedy and ultimate solution.

Today there is no question that our principal resources need husbanding, revitalizing, better management, more multiple-purpose development. Yet, to sustain the productive obligations—not merely in terms of a few short years of heroic effort but in terms of generations—the endeavor of Government and collaborating industry and agriculture must be sharply increased merely to keep the national resources and their use in true balance.

Land and Water

The depredations of wind, water, and man are now responsible, in the continental United States, for the loss of 500,000 acres of topsoil each year. This is equivalent to the acres needed to support some 175,000 people with food and clothing at accepted standards of living. This is good, fertile, and priceless topsoil which has washed away down the rivers to the sea, forever lost. The effect of this loss is not merely numerical. This stripping robs many times that number of acres of their productivity, reduces some to sheer wastelands, and increases the burdens of production on others to a point of diminishing returns.

Today, it is estimated that about 429,000,000 acres of good crop-lands are required to maintain an adequate agriculture. The area of land not now used for crops but which can be made usable at low cost is relatively small. A population increase of 10,000,000, expected in 1960, would absorb the production for which this reserve provides. Even our net reserve is not stable, but is reduced each year by the loss of topsoil, the leaching of soil nutrients, and the decrease of productivity from marginal acreage. Furthermore, much of the reserve is in land not available for immediate cropping. Part of it requires reclamation; by drainage, by the careful subjugation of infertile and rough lands, by clearing, or by irrigation.

The question is whether present program levels of soil conservation, f the retirement of worn-out acres and their gradual rehabilitation, f supplemental and new irrigation can match the depredations of rosion and overuse and the increased demands of new population. The answer is: "No, not yet." The answer could be permanently "No," should the national effort of land conservation and development alter. The air traveler of the future will either gaze upon a vista f desolation or one of geometrical patterns of soil-conservation furows and irrigation and drainage canals. One will mean the decline f our great American civilization; the other will spell continued rogress and national well-being.

The Department's responsibilities in land management and water tilization—as exercised by its Bureau of Reclamation and its Bureau f Land Management—have been successfully discharged in the past. The current effort is by no means comparable to the minimum task head. For example, the Bureau of Reclamation proposed to open to entry some 71,000 acres of public land during the fiscal year 1948. This is land which has been carefully prepared for irrigation, for which adequate water supplies will be available from extensive systems of reservoirs and canals. The puny nature of this achievement is revealed when compared to the equivalent loss resulting from the erosion of 500,000 acres of topsoil per year.

In the range lands of the West, where a large portion of the livestock requirements of the United States is obtained, about 230,000,000 acres are administered by the Department. Fully half of these need some restorative attention, and perhaps as much as a fifth already are in critical condition. Remedial treatment has only been at the rate of a little over 1,000,000 acres per year. The Department's Bureau of Land Management has under way a conservation program on some 11,000,000 acres, with another 49,000,000 scheduled for the immediate future. This type of program must be accelerated far beyond its present rate if the feeding livestock population on this range land is to be maintained at minimum levels demanded by the meat, leather, and wool requirements of the Nation. The western range lands administered by the Department should graze one cow or five sheep per hundred acres, but the requisite acreage for production feeding will be inadequate if erosion and overgrazing are permitted to reduce the range capacity any further. With increase of population in the western country, the problem will be one of increasing range capacity rather than increasing the size of the range.

These examples highlight a critical situation. It can be alleviated by intensification of soil conservation, reseeding, fertilizer production and application, managing of the present range grass, and rapid increase in the number and extent of multiple-purpose river basin development projects.

River Basin Development

In the latter respect, the various elements of basin development are so completely interdependent that unrelated development of one set of resources, of one area, or of a single economic phase may retard or irreparably damage others of equal importance elsewhere. For instance, the development of a comparatively simple irrigation project must consider the effect of channel alterations on fish runs, the comparative value of the lands to be inundated under the supplying reservoir, the basin requirements for specific crops and livestock feeds, the need for hydroelectric power to be produced as a byproduct of water control, and many other items of considerable importance. Irrigated agriculture must mesh with dry-land farming. The economic justification for undertaking major development in the first place must have prominent relationship to probable industrial and commercial expansion.

The great river basins of the West—the Colorado, the Columbia, the Missouri, the Central Valley of California, the Rio Grande, the Arkansas—still contain a potential development which will go far toward meeting land requirements. They also provide an economic base for the balanced industrial and agricultural development of the West.

The prehistoric peoples who managed many centuries ago to exist in the forbidding Colorado River Basin by means of simple irrigation diversion had enormous resources within physical reach and almost none at their command. With minimal development of the soil and water resource, they were unable to tap the larger potentialities of the valley. After them the Spaniards and the American pioneers failed equally to see the basin as a whole. After a generation of development climaxed by construction of Hoover Dam by the Bureau of Reclamation, half of the water of the Colorado River is still wasting to the sea. Hundreds of thousands of acres of irrigable lands of proven fertility produce nothing but a scanty yield of grass for grazing. A vast, unrealized hydroelectric potential posts up a measurable productive loss in terms of tangible wealth. Mineral and chemical industry progress is barely noticeable.

Yet the ground work has been done. Many billion kilowatt-hours of electricity have been produced by the river. With power from Hoover Dam it was possible, under stress of war, to build and operate in the basin the world's largest magnesium plant. The competition between prospective lessors for a power contract illustrates the nature of basin problems.

Piecemeal development of the Colorado Basin has left it unbalanced and lopsided. The requirements of the basin itself have rarely been as persuasive as other needs and demands. Much of the existing first-stage construction was made possible because the city of Los Angeles and southern California generally had to have additional power and water. While the ores and phosphates of the Colorado Basin for the most part lie undisturbed in the earth, and its industrial-business-agricultural expansion waits in the uncertain future, lack of developed power from the river hampers the development of industry within the basin.

Few people live in the vast, almost empty reaches of this lonely basin although it comprises about one-twelfth of the continental land area of the United States. Few industries turn a wheel. Cities, even towns, are scarce and most of them depend on the irrigated hinterland.

While World War II veterans vainly seek irrigated farmsteads, more than 1,500,000 acres of irrigable land await development in the Colorado Basin. The more than 18,000 farms that can be carved from this sage-covered waste can be confidently expected to return a gross income of almost three-quarters of a billion dollars a year.

The mineral resources of the Colorado Basin include metals which are in short supply through war depletion; precious metals; liquid, gaseous, and solid fuels; and great beds of thinly covered phosphate rock. Copper, molybdenum, vanadium, gold, and silver constitute the most important metals. Fuel potentialities comprise natural gas, oil, and about one-fourth of the Nation's bituminous and subbituminous coal reserves. The phosphate rock at the Utah-Wyoming-Colorado corner together with those of Montana and Idaho forms a foundation for a mammoth western fertilizer industry to provide a much needed reserve from which superphosphate may be drawn to renew debilitated land in the entire Nation.

Plentiful, low-cost hydroelectric power, resulting from the requisite harnessing of the Colorado and its tributaries for a capacity of 3,500,000 future kilowatts will allow use of these latent industrial resources and help toward a balanced economy for the entire basin.

Such integrated development is forecast in the comprehensive report prepared by the Bureau of Reclamation which will be submitted to the Congress early in 1948. This report is a prospectus for national investment in the Colorado Basin. The first stage of the basin development is complete or under construction. It represents a Federal investment of about $275,000,000 upon which handsome returns have been received. A sound second stage that should follow the first to reinforce and multiply its benefits might call for an investment in the neighborhood of a billion dollars or more. Such a second stage would be a step toward full utilization of the water of the Colorado Basin, but would not exhaust it or close the door to revisions in the over-all plans to meet unforeseeable conditions in the century that may elapse before it is complete.

The Colorado Basin is a market for Federal investment because it is too big for private business or a single State. The benefits—transcending State and regional lines—are of such importance to the national economy and security that they must be achieved.

Whereas the Colorado basin is in relatively primitive stages of development, the Missouri Basin presents contrasting aspects. A constant leakage of human resources from the Missouri Basin since the onset of the great droughts of the '30's has served to accentuate the unstable condition of the Great Plains economy. The droughts upset a region already far off balance. There was no integration of town and hinterland, of dry land with irrigated land—there was, indeed, little irrigated land in the entire basin. Relief expenditures totaling more than a billion and a half dollars—exceeding the estimated cost of the comprehensive plan at present prices—were doled out in the area during the drought. There was no satisfactory adjustment of business, agriculture, and industry, each to the other, to the land and water resource, or to the vagaries and peculiarities of the erratic, subhumid climate.

About 10 years of high-level construction would set the pattern for reconciliation of the most discordant factors in the Missouri Basin. Five years of continued construction will allow an increase in population of 600,000, bring into crop production some 5,000,000 acres of dry lands, protect millions of acres from periodic devastation by flood, and set up the basic framework of the integral power structure. The Missouri Basin resource development prospectus is an inviting one, with a heavy balance on the credit side more than amply justifying the multibillion dollar Federal investment sought by the valley.

First things must come first in the basin. Before the finer, more complex, adjustments can be attempted, the major dams, irrigation, power, and water supply features must be completed. They are the nuclei upon which the comprehensive valley development will form. Agricultural stability cannot exist until irrigated and dry-land use is integrated. That is a basic and primary adjustment upon which preliminary work is already going forward, and which must be made rapidly once the irrigation systems go into operation. The problems it poses are challenging, and will require the utmost cooperation for their resolution.

For example, land speculation in the past, probably more than any other single factor, operated to destroy the value of the human assets and seriously to imperil the irrigation investment. Inadequate controls left many settlers prey to the speculator. The latter—not the irrigation farmer—reaped the harvest from Federal irrigation. The settler was sold almost valueless dry land at fantastic prices that often exceeded its ultimate worth with all improvements and the irrigation system in. It is not surprising that often the first, the second, or the third group of settlers failed.

From the first the reclamation laws asserted an inviolable policy of providing a maximum number of farming opportunities for the greatest possible number of citizens. The Congress made clear, and has reaffirmed in numerous restatements in the 45 years since, its intention to restrict the use of Federal funds for irrigation development to the family farm. The law specifically excludes irrigation expenditures for the benefit of a handful of large landholders or corporations.

Land speculation has operated to defeat both purposes of the law. And the Federal Government, as another result, was left with a weakened security for its investment. Bankrupt settlers cannot repay project construction costs.

New problems concerning the repayment of construction costs confront the Bureau of Reclamation and the water users as a general result of the large cost increases since the war, hydrologic conditions in the Missouri Basin, and the requirements of comprehensive valley development.

On projects where construction was begun before or during the war and not completed, it has generally been necessary to reopen repayment contract negotiations to develop amendatory contracts reflecting the cost increases. In some instances where the annual construction obligation was at or near the top limit of the water users' repayment ability, authority to extend the payments over an extended period exceeding 40 years has been granted by the Congress.

The higher labor, material, and equipment costs seriously affect the feasibility of projects so that many which are otherwise desirable cannot be constructed now.

The terrific flash floods encountered in the Missouri Basin add materially to construction costs and complicate engineering design. Spillways with sufficient capacity to pass the flood flows without damage to the dams are large and expensive, comprising a major portion of the costs of the structures. In the case of Heart Butte Dam of the Heart River unit of the Missouri Basin project, the spillway structure was redesigned in an effort to scale down construction costs to an amount within the repayment ability of the water users.

Comprehensive valley planning must meet different tests and a greater variety of needs than single project development. Fully to utilize the water resources of a valley such as the Columbia in the Northwest requires numerous structures devoted to different purposes, but integrated on a large scale in a manner similar to the closely knit functions of a single multiple-purpose dam. In the Columbia Basin are numerous power sites without any possible irirgation features, and potential irrigation projects with no power features. There are also flood control and navigation facilities with large power features. So it is proposed to pool the power revenues of the entire basin to enable development of the irrigation projects that lack power potential.

The Public Domain

There are, of course, areas within the limits of river basins which are not arable because of topography, the nature of the soil and its cover, and other physical reasons. Yet, these vast areas, usually at high altitude or of mountainous character have existing and potential contributions to the Nation's requirements for timber, livestock, and recreation. Most of these lands are in the public domain. In the truest sense, they are the people's land. Covered in many sections with valuable timber, these lands contain other major values—minerals, scenic beauties, and watersheds of incalculable importance. Their protection and their management is urgent, for their depredation by either natural causes, such as wind and water erosion, or by misuse such as overcutting of timber and overgrazing, has serious impact on the well-being of the peoples of the river basins—the people of the Nation.

There remain in continental United States today 413,000,000 acres of public domain. National forest lands, which are administered by the Department of Agriculture, comprise 138,000,000 acres of this. Most of the balance is administered by the Department of the Interior including 170,000,000 acres of unreserved land (including 132,000,000 acres in grazing districts), 55,000,000 in Indian reservations, and 12,000,000 in national parks and monuments. The remaining areas of 38,000,000 acres are in reclamation, military, and other reservations.

For many years the open public range land in the West was a free-for-all public grazing common. The damage which has resulted from this practice prior to regulation came from lack of distribution of use as livestock concentrated around permanent watering facilities and from overgrazing through excessive numbers of stock and too-long or unseasonable use of the range. The result over large areas has been depletion or eradication of palatable and nutritious vegetation and in places its replacement by unpalatable and less nutritious species, together with accelerated erosion of rich topsoil.

The important consequences of such practice have been a gradual reduction in the capacity of the range to carry stock, and a proportionate increase in the cost of raising cattle. The end result has been more expensive meat for the consumer, less gain for the stockman, and reduction in over-all production capacity of the Nation.

During the year, demands that the public domain with grazing and other public lands be sold to private holders increased. While the campaign centers on the grazing lands, it may involve other public lands. This campaign has been gaining momentum since the early days of the war. It has been stimulated in large part by the high prices for livestock, by a widespread reaction against the strict wartime Government controls, and by a reaction against purchases by the Government of privately owned land for military purposes. Proposals to transfer western public grazing lands to private ownership take two directions—the direct sale of these lands to stockmen, and transfer of the lands to Western States, which presumably would sell them to stockmen.

Agitation for Federal control of the western range began many years ago. Authority for control of the ranges in the forest reserves was provided for by Congress in 1897, and effective control was established by the Forest Service in 1905. It was not until 1928 that effective action was taken. A special act of Congress authorized the Secretary of the Interior to enter into an agreement with the State of Montana and private landowners in specified townships for the purpose of enabling stockmen to lease Federal, State, and private lands and put them under control as a grazing district. A general bill for creation of grazing districts passed the House in the Seventy-second Congress. The Taylor Act was passed by the Seventy-third Congress and approved by the President on June 28, 1934.

This act directs the Secretary of the Interior to make provision for the protection, administration, regulation, and improvement of grazing districts; to make rules to insure achievement of objectives; to regulate their occupancy and use, and to provide for the orderly use, management, and development of the range. Sixty grazing districts embracing 255,000,000 acres, of which 141,000,000 are Federal lands, have been established in 10 Western States. They are grazed by some 9,000,000 head of livestock—cattle, horses, sheep, and goats—belonging to 21,000 stockmen.

Conservation of range resources in grazing districts is accomplished through proper grazing use, protection against range fires, and damage by rodents and insects, and operations to prevent soil erosion and moisture losses. Orderly use is obtained through a system of issuing 10-year grazing permits. The Forest Service has administered a similar system of grazing permits on some 80,000,000 acres of grazing land in national forests for more than 40 years.

Some range users now seek to effect the sale of the public grazing lands at an average price of 42 cents an acre, a sum which appears to take no account of the Federal Government's original investment in these lands, plus the many millions of dollars which have been spent in the interest of all of the people on their rehabilitation and improvement to repair the damages originally inflicted by stockmen.

An extremely important reason for opposing this proposal of the stockmen lies in the fact that every irrigation farmer in the West has a direct interest in preserving the land cover against erosion. The public grazing lands together with the forested lands higher on the mountain slopes lie almost wholly within the drainage basins in which are located virtually all of the 21,000,000 acres of irrigated farmland. Production from the irrigated lands depends altogether upon the water which runs off the grazing and forest lands. The manner in which such lands are handled detracts from or enhances the value of the irrigated lands in amounts which might easily exceed the total value of the grazing lands. If the grazing lands are properly handled, the flow of water into the streams which form the sources of irrigation water is stabilized and may contain a relatively small quantity of silt. The need for water storage is decreased and the life of costly storage reservoirs is greatly increased.

It is proposed that many billions of dollars be invested in irrigation and power projects in our Western States. In fact, the future development and prosperity of these States depends largely upon these water resource developments. If, however, unrestricted grazing practices be permitted to flourish on the western range, many of the proposed reservoirs will be threatened with rapid siltation, thus endangering a large part of the resource development program, the future of which depends upon conservation of water resources.

Sometimes those who ask that the public domain be turned over tc the States forget that these States, in which the public domain is mostly to be found, already have obtained large benefits. Too few o the States have effective conservation programs for the land they received. More than 70,000,000 acres have been granted to the 1 Western States in aid of education and various other purposes. A large portion of the States' receipts from the public lands comes from the proceeds realized by the Department of the Interior from the mineral leasing acts, of which 37½ percent go to State treasuries Since the passage of the first mineral leasing act in 1920, State receipt from this source have aggregated $63,000,000. More than $97,000,00 of mineral leasing receipts have been allocated to the Reclamatio fund, all of which is spent for the benefit of Western States.

At the outset of the fiscal year divergent views in Congress ove the need for an increase in fees charged for grazing on the public lan forced a virtual abandonment of the program originally contemplated under the Taylor Grazing Act. One body of Congress maintained tha the cost of administration of the structure, which included 60 Federal grazing districts, should be met from the collection of grazing fees and that the rate charged should be increased for that purpose; the other body was opposed to any increase in fees at that time.

The net result was such a drastic reduction in the appropriations for the 1947 fiscal year as to cut the available working force from 205 to 60 persons, thus placing the whole range administration schedule on a skeleton basis for the year. Individual stockmen and their local organizations, alarmed at the threat to orderly range administration, voluntarily contributed more than $200,000 to reopen offices and continue the work in some districts.

Definite steps toward a solution of this dilemma were taken by the Department in May 1947, when an increase of 3 cents per head per month for cattle and horses, and three-fifths of a cent for sheep and goats was put into effect. This new rate of 8 cents for cattle and horses, and 1⅗ cents for sheep and goats was one of the outstanding recommendations contained in a special report on grazing land administration prepared by Rex L. Nicholson of San Francisco.

At the same time, a special study was made by the Bureau of Agricultural Economics to determine the proportion of range administration cost which should be evaluated as representing direct benefit to the stockmen and that regarded as in the general public interest. That study, recently completed, shows that the stockmen's share on the basis of 1945 and 1946 expenditures is 70 percent and the general public's share 30 percent of the total cost of range management.

Federal legislation enacted in the closing days of the Eightieth Congress provided for a redistribution of amounts received from the grazing fees so as to increase the Government's share in relation to the amounts appropriated for administrative purposes. Detailed arrangements have been made to put this beneficial legislation into actual practice during the 1948 fiscal year. As a result it is contemplated that a full complement of district offices can be provided for during the coming year.

As part of its management functions over the public domain, the Department of the Interior administers more than 400,000,000 acres of forest and range land in the States and in Alaska which are in need of fire protection. In its fire-protection activities, the Department adheres to the "minimum cost-plus-loss" principle which in effect provides that expenditures for protection may be justified up to the point where additional expenditures are not balanced by a reduction in losses. This is the point at which the rate of expenditure is the most economical.

Generally, expenditures for fire protection on lands administered by the Department of the Interior, with perhaps the exception of those on the land administered by the National Park Service, always have been lower than would be justified by the "minimum cost-plus-loss" formula. During the fiscal year 1947, funds available to the Department for fire prevention, presuppression, and suppression totaled only $1,330,000, or about 3 mills per acre for the entire 400,000,000 acres requiring protection from fire. As actually allocated between the lands requiring protection in the continental United States and Alaska, 6 mills per acre were provided in the States and 0.8 mill per acre in Alaska. These rates are obviously inadequate to provide needed fire protection for the lands under the Department's jurisdiction.

The effectiveness of the fire-control program of the Bureau of Land Management suffered two severe set-backs during the year: first through a major reduction in funds for grazing district administration and protection, and second, through a material curtailment of cooperation previously afforded in Alaska by the United States Army. The effect of the cut in funds for grazing districts will not be reflected in fire loss records until the calendar year 1947 is reported, but the 1946 record does reflect strikingly the loss of Army cooperation in fighting fires in Alaska. On all the lands administered by the Department, there were 2,559 fires during the calendar year 1946, as contrasted with 2,435 fires during the calendar year 1945.

The 1946 loss was more than doubled, however, with 1,857,000 acres burned over in 1946 as against only 845,000 acres burned over in 1945. The major portion of the 1946 loss was in Alaska where 1,437,000 acres of public domain land were burned. In 1947 a fire, covering 350,000 acres on the Kenai Peninsula, raged uncontrolled for months destroying valuable timber and big game and wildlife. It is probable that had sufficient funds been available at the outset of the fire, sufficient fire crews could have been employed and the blaze confined to small proportions.

National Parks

The National Park Service was dedicated to the preservation of outstanding scenic, scientific, and historic values of the Nation. It has unalterably opposed the frequent attempts made to enter into those precincts set aside by congressional law for the enjoyment of generations of the American public. It has been staunchly supported for the public is keenly aware of the pleasures it can obtain from the unspoiled areas of national parks, monuments, and forest lands.

Although the fullest possible protection of the natural and historic resources entrusted to it is a basic principle of management laid upon the National Park Service by law, public use, and enjoyment of these resources is, of course, the primary justification for setting aside these reservations. The resources in park areas are preserved because of a conviction that only in that manner can they provide human beings with the greatest satisfaction now and in the future.

The sheer weight of the numbers who come to many of the most popular areas, and the fact that the Service's field forces continue to be insufficient for proper protection against the careless and the vandalistic, accentuate a replanning problem which has existed for many years. The essence of it is to provide for the public enjoyment of these places with reasonable convenience and comfort but without impairing their continuing capacity to provide such enjoyment. In some cases, it must envisage the gradual removal from present sites of existing facilities and their restablishment elsewhere, where intensive use will be less damaging to natural features of high value or where there is more adequate space in which to meet existing and expected demand. These changes must be gradual because, first, service to the public cannot be seriously interrupted and, second, the investment, even in badly placed or unsatisfactory facilities, cannot be written off with a stroke of the pen. Added to this is the fact that the public, long used to certain accommodations, needs time to adjust itself to changes of location.

A general principle which has long guided the National Park Service in its planning has been that of devoting to intensive use no more space than was genuinely necessary and of providing for it at only a limited number of locations. In many of the parks, the tremendous amount of camping during the past 2 years has subjected the available campgrounds to a degree of over use that calls for remedy as soon as it can be provided. Not only is more camping space badly needed; other campgrounds need to be developed so that those now in use may be given a rest, and the natural vegetation given an opportunity to recuperate.

In some instances, replanning will involve the placing of restrictions on the visitor's freedom of action and movement so that fragile resources may be used without being destroyed. Such restrictions are now being applied in certain places where the necessity has become plainly apparent. At Mesa Verde, for example, the visitor may see Cliff Palace close at hand, but he is no longer permitted to wander freely through these remarkable ruins. Experience has shown that this practice was causing a steady and serious deterioration in the ancient structures. At Yellowstone, it is necessary to prescribe certain routes among the thermal formations, both to limit wear and tear on them and to curb vandalism. At Montezuma Castle National Monument, in New Mexico, serious consideration is being given to restricting access to the lofty cliff-dwelling to those who are engaged in serious study of such prehistoric remains. As is the case in many areas administered by the Service, original construction was not calculated for heavy public visitation. In such a structure as the home of Franklin D. Roosevelt it is possible to shore up heavily used stairways and to strengthen the building in other ways without the public being aware of it or without any material change in its appearance; but such procedures are not adaptable to prehistoric masonry, except to a very limited extent.

Use, of one kind or another, is intended for all areas in the national park system; without it, there can be no justification for them. But when its kind and extent is such as to cause steady deterioration or destruction of the very features on which monument or other special status is based, the Service has no alternative but to apply limitations upon public freedom of movement and action, however much it may regret the necessity of doing so. Future generations have rights to enjoyment which we are compelled, both by law and common sense, to respect.

Fish and Wildlife

By proper management, vast areas of land and water—both fresh and salt—can be made to yield other crops essential to the national well-being. The use of our wildlife resources for food, furs, and recreation has always been a part of our national life. However, the phenomenal increase in the rate of this use, combined with a diminishing favorable climate for wildlife existence, threatens survival of the resource.

Natural biological resources are an important part of the expanding economy of our country and of the world. The capital value in the United States of these resources—including all the wild or undomesticated mammals, birds, and fishes—has been estimated at more than $14,000,000,000. The utilization of these resources has far-reaching effects on the national economy. Probably as much as $4,000,000,000 worth of goods and services are sold each year in the United States to hunters, fishermen, and others who derive recreation from wildlife. In terms of direct commercial value, the fisheries alone are valued at about $7,000,000,000 on the basis of their present earnings.

While the living resources, in contrast to coal, petroleum, or metals, are renewable, they cannot withstand such mounting pressure if we pursue the traditional course of neglect. The demands of the present and predictable demands of the future can be met only by so managing the wildlife populations that the natural increase is greater than the annual withdrawal. This can be done only by national sponsorship of a realistic and positive program of wildlife conservation on a scale not hitherto attempted.

The difficulties of the situation are increased by the fact that the mounting demand for large populations of fishes, game birds, and animals exists in the midst of a national economy characterized by forces which tend to destroy or render sterile and unproductive the habitats upon which wildlife depends for its existence. The control of industrial and urbanizing forces, the clear recognition of the needs of wildlife, and the aggressive preservation of at least minimum areas of suitable land, water, and marsh are indispensable to the retention of our wildlife populations.

Drainage of marsh lands, too often practiced indiscriminately and without plan, must assume a heavy responsibility for the decline of the waterfowl. It has destroyed most of the former nesting areas in the United States and rendered useless vast acreages of southern wintering grounds. The oil fields of the Gulf States, now being extended eastward, have damaged extensive aquatic habitats. Thousands of freshwater duck marshes have been injured by salt water brought in via the Intra-coastal Waterway, and other wildlife habitats have been ruined by the diversion of whole rivers into new channels. The character of many river bottoms, normally among the best wildlife habitats, has been changed by canalization.

In an effort to provide intelligent solutions for some of these difficulties, the Fish and Wildlife Service is actively pursuing its studies of river-basin problems. A strengthening of legal authority for these studies was given during the past year by the enactment of Public Law No. 732, providing that utilization of the resources of a river shall include the fullest possible development of its resources of fish and other wildlife.

One of the most encouraging of recent events is the broadening of activity in the field of wildlife restoration projects under the Pittman-Robertson Act. These projects, subject to Federal approval, are carried out by the States and are jointly financed—75 percent by Federal and 25 percent by State funds. The Federal contributions are derived from an 11 percent excise tax on sporting arms and ammunition. From the funds thus accumulated, the Congress has annually appropriated sums ranging from $1,000,000 to $2,750,000 for apportionment among the States. In 1947, however, Congress specified that all money derived from this tax during the fiscal year 1947 should be made available for Pittman-Robertson projects in the fiscal year 1948. Because of the great increase in hunters and hunting during the year, and because many items of equipment became available for the first time since the war, receipts from this tax in 1947 have been estimated at approximately $9,000,000. The largest previous receipts were about $5,500,000 in 1941, but the largest amount previously appropriated for wildlife projects was $2,750,000 in 1942. Carefully planned use of the additional funds now available could bring about much better conditions for wildlife.

The conservation of the commercial fishery resources, however, is primarily a problem of managed utilization rather than of habitat improvement. These resources are for the most part marine, inhabiting a world where man has little control over physical conditions.

If we were formerly inclined to minimize the direct economic utility of our wildlife resources, World War II taught us the error of this view. In the fisheries we have not only an element of national wealth, but a source of food and industrial materials whose strategic importance was then sharply emphasized. Needing twice as much fish for food as our industry was able to produce, faced with the necessity of suddenly developing industries to produce agar, vitamin A oils, and other fishery products we had been accustomed to import, we received an object lesson in the importance of developing all the potential wealth of our aquatic resources.

The average yield of our commercial fisheries is now 4,200,000,000 pounds a year. This is considerably below their biological potential which scientists estimate at about 6,500,000,000 pounds. This maximum yield could be realized by such means as developing fisheries in areas hitherto little exploited, by discovering new uses for known resources that are now underutilized, by expanding markets in the interior of the country, and by applying to the management of our aquatic resources the principles developed through biological research.

Although more than 90 percent of our annual fish catch is taken from the oceans, fishery research in the United States has for many years been confined largely to laboratories on land. Every other country with important fisheries has had from one to a score or more of fishery research vessels. The United States, ranking second in the volume of world fishery production, has not made the small investment necessary to send even one vessel to sea for the investigations needed to understand the forces that control replenishment of the fish populations. Toward the end of the fiscal year 1947, however, funds were provided by Congress for the operation of a research ship in the North Atlantic. With this vessel a small beginning can be made in filling in the gaps in our understanding of the basic science of the marine fisheries. Considering the magnitude of our fisheries and the immense area they cover, not one but half a dozen or more such vessels are needed.

Fishery science in Alaska, where the Department of the Interior, through the Fish and Wildlife Service, manages the fisheries directly, has paid substantial dividends, of which one or two examples may be given here. The Alaska herring fishery, under a "catch quota" system of management based on biological studies, recovered from an extremely precarious state a decade ago to yield, last year, a catch worth $2,000,000. Scientifically directed improvement of salmon streams in southeastern Alaska is being undertaken to increase the usable spawning areas, from which we may expect additions to the annual runs worth several million dollars. Such methods can be developed and applied to other fisheries, resulting in more stabilized yields.

Before the United States can get the most out of its fishery resources, it must not only insure their continued productivity by scientific research, but also bring about better methods of processing, distributing, and marketing. Experiences of recent years have demonstrated how important fish can be as buffers in our national situation during periods of meat shortages. Yet consumption of fish in different sections of the country is extremely variable, largely because our present methods of processing and distribution are not adjusted to the distances between producing centers and the interior markets. In this field, research of the most practical sort is needed.

Not only in the United States, but in the world as a whole, the importance of conserving and managing the natural biological resources is now receiving more adequate recognition. Underdeveloped and underutilized biological resources in areas where great shortages of food supplies and other products derived from the resources exist, afford opportunities for greater utilization and development. Other areas where the natural biological resources have been depleted or wasted through lack of scientific management, challenge the conservationist to restore them. Realization of these facts has brought about an international unity of effort in conservation such as exists in few other fields.

Basic Data

One of the basic needs for the planning and execution of an adequate management program is full information on land, on its topography and the location and extent of water sources. This foundation must be provided through a continuous collection of facts to bring these data up to date and to complete the record where necessary.

At present, less than 25 percent of the Nation is covered by topographic maps adequate for present-day requirements. Half of the Nation is entirely without topographic maps. This means that, in the continental United States alone, almost 2,300,000 square miles must be mapped, and some 500,000 square miles, covered in the past, must be remapped. Adding to this total the requirements for Alaska alone, makes the task ahead a staggering one. Without these maps, geological exploration and resource roads, canals, dams, and other large installations—can only reflect approximate resolutions of important locational problems.

Geological Survey

The Geological Survey has outlined a 20-year program for the reasonable completion of topographic mapping. Intensive aerial photography and surveying make it possible for the job to be done. At the end of that time, if sufficient funds are provided without interruptions, the talents of the road builders, the irrigators, the flood-control and soil-conservation engineers, and many others will finally possess a tool of which they have been long deprived. Urgent requests from the War Department, the Public Roads Administration, the Inter-Agency Committee on River Basins, other Federal and State agencies, together with many interested organizations, form a backlog which cannot be disregarded.

If national topographic mapping has been lacking, water measurement is far worse. For the 53 years during which the Geological Survey has had primary responsibility in water measurement, the amount expended for that purpose has barely totaled $25,000,000. And yet, it is upon those measurements that depend not only the very existence of millions of people but the programs of resource conservation and development which insure their survival.

The occurrence of water—in streams and in lakes—is subject to many vagaries. Precipitation in the form of rain or snow is gathered together from the mountain tops, the hillsides, the fields, and the swamps. The amount which finally returns to the ocean, where the everlasting hydrologic cycle begins again, and that amount which seeps into the soil, are the amounts which determine the extent of our crops, the limits to which we can supply water for domestic and industrial purposes, the magnitude of the hydroelectric power which we can generate. Thus it is that we must know, with precision, how much water flows in our streams, how much collects in lakes and reservoirs, how much seeps into the ground to be accumulated in the water-table. Without a fair understanding of the peculiarities of our natural water systems, it is palpably difficult for us to utilize water for beneficial uses and to control it in the prevention of disaster.

The necessity for continuing water investigations arises from the fluctuations in available water supplies resulting from variations in precipitation and other climatic factors. This essential natural resource is not fixed in amount, quality, availability, or utility. Because it is mobile and changing, observations of its fluctuations must be continued to insure its wise and full use in the public interest.

It is difficult to measure the value of information of this type, but it is conservative to say that the derived benefits are many times greater than the cost of procurement. In negative terms, the costs of not having that information for the proper planning of reservoirs, of flood-control works, of municipal water systems, and the like are immeasurable.

Inasmuch as continuity of water records are imperative so as to determine constancy of supply, occurrence of shortages and floods, programs should reflect long-range scheduling and a consequent appropriation of funds year after year.

Minerals

Minerals form the base of our industrial economy. The demands of modern technology have increased the number of essential minerals—essential for the maintenance and expansion of industry—to the point where practically all known mineral substances have some estimable value. The national consumption of such minerals may range from the hundred million tons to perhaps only a few hundred pounds. Yet, the interdependence of substances derived from minerals is so great that a deficiency of a few hundred pounds may delineate the future of the Nation.

The vagaries of mineral occurrence, which follow no concept of nationalistic pride, make no nation self-sufficient in its essential mineral supplies—and the United States is no exception. Roughly, this is the score on the United States' capacity to produce mineral raw materials:

Coal, salt, sulfur, iron ore, molybdenum, potash, phosphate rock, sand, and gravel appear to be present in adequate amounts, at least for several decades, although supplies of high-grade iron ore and first rank coking coal are limited.

Tin, nickel, quartz crystals, industrial diamonds, and platinum metals are in scant supply, and from what we know now of our geology it appears unlikely that adequate amounts ever will be discovered.

So lavish has been our use of copper, lead, and zinc that developed reserves are insufficient to meet our current needs, without intensified exploration and discovery of new sources, and we shall continue to depend on imports to supplement our own production.

Tungsten, vanadium, manganese, chromium, mercury, asbestos, and a considerable list of other less-well-known minerals have been in short supply for several years. The industrial importance of this group grew tremendously during the war, and indications are that demands for them will continue at a high level. Some of these we probably shall be able to supply in large amounts—a few perhaps adequately.

The fact that we are now exploiting or have exhausted the easily discovered mineral deposits in this country, mainly those which show surface evidence of their existence, does not mean that there are no more minerals underground. Modern geological reseach methods are pointing the way to unpredictable new stores of minerals. Furthermore, technology can be developed to utilize some reserves of mineral ores here tofore not thought commercially valuable.

Thus, the attack on the problem of mineral self-sufficiency is a two-pronged one: intensive exploration and intensive utilization research. To bulwark this offensive, there must be added the importation and stock-piling materials in which we find ourselves currently lacking, or in which the future holds little promise of adequate domestic supplies.

Inventory and Exploration

Fortunately, mineral deposits follow natural laws of occurrence; geologic processes in the remote past determined their location, size, and richness. Hence, they can be discovered best by tracing the geologic story backward. Systematic geologic mapping can eliminate much useless prospecting and thereby concentrate search on relatively small, promising areas. The exploratory surveys necessary to block out the most promising areas must ultimately cover the entire United States. Such work, intended to fit into the long-term project, is in progress in most of the 48 States, but the task is formidable because of its size and the lack of adequate and comprehensive preliminary geologic mapping. When favorable areas are determined, however, the search can be focused still more sharply through more detailed geologic studies, aided by two highly specialized techniques—geophysical and geochemical surveys.

Geophysical surveys, long employed in petroleum exploration, are becoming increasingly important. Sensitive magnetic and electrical instruments, some of which operate on the principle of the air-borne submarine detector developed during the war, measure minute deviations in the magnetic field of the earth, or record small differences in the electrical capacities of the rocks; either of these may indicate the presence of buried ore bodies. Geophysical surveys therefore, are an economical way of probing below the surface. The equipment owned by the Geological Survey is in constant use in both the United States and Alaska, and the results thus far obtained indicate that such work could be expanded profitably fourfold.

The relatively new field of geochemical prospecting is now being explored by the Geological Survey. It already has been demonstrated that the soil, water, and plants above and around ore bodies contain minute quantities of related metallic elements. Where such pointers are found there remains only the problem of finding the center of the concentration, below which, somewhere, an ore body may lie. Research to develop sensitive analytical techniques for rapid use in the field is being pressed. Practical exploratory procedure depends upon the outcome of this research.

Comparatively few realize that through this Government all the people of the United States are in the coal, oil, gas, potash, sodium phosphate, and oil-shale business, and derive from these industries an annual income in rents, royalties, and bonuses that now exceeds $15,000,000 and is steadily increasing.

The total reserves of the various mineral fuels, fertilizer constituents, and chemical compounds of industrial value that are subject to the Federal mineral-leasing laws in the public-land States are as yet undetermined. From the evidence accumulated to date, however, they are estimated to be of such magnitude and wide distribution in the area west of the one-hundredth meridian, as to remove any fear of the exhaustion of many important minerals for several generations, if intelligently administered. Each branch of the Geological Survey is contributing annually to the growing fund of quantitative data concerning these resources and the varying factors that govern the feasibility of their developments; all stand ready to share the findings and conclusions with others who may contemplate exploration for and development of the minerals that are now subject to the Federal mineral-leasing laws.

Study of the factual records of the Department of the Interior relating to the accomplishments in administration of the mineral-leasing laws discloses that the development of mineral resources under those laws has paid large cash dividends in royalties to the United States Treasury, to the States and to the Reclamation fund, in addition to affecting marked conservation of our national supplies. Even greater conservation accomplishments can be attained, provided the Nation is willing to contribute a more substantial annual investment for the protection and utilization of its mineral resources on Federal and Indian lands.

One of the greatest needs of the Nation today is the discovery of new oil fields, in order to remove the pressure upon presently producing areas, which could be more economically developed if the pressure for their product were not so great. To this end the Survey is bending considerable effort to expand systematic investigations in many parts of the country, to focus attention on areas attractive for exploration, and to provide a sound ground work of regional geologic information by which the search for new pools can be guided.

As a means of conserving or replacing petroleum, more and more critical consideration is being given by industry and by Government agencies to the feasibility of converting coal to liquid and gaseous fuels. Fundamental surveys and studies of the grade, thickness, reserves, and accessibility of the several classes and kinds of coal are thus more urgently needed than ever before. During the current fiscal year, only a slight expansion of our modest program of coal investigations will be possible.

Although aimed primarily at finding new sources of oil, gas, metals, and industrial minerals, the investigations of the Geological Survey have been of greater practical value than is generally realized in assisting in the development of already known mineral resources, in determining quantity and quality of essential water supplies, in solving mine-water problems, in selecting dam sites, planning highway routes, retarding landslides, and facilitating soil surveys.

Along with this work, purely scientific programs that offer the chance of formulating new solutions to old problems and of opening new horizons are followed. A typical scientific problem is the program of volcano research, designed for the eventual purpose of predicting eruptions through an understanding of volcanic phenomena. Such fields of investigations, though occupying only a small part of the program of the Geological Survey, are typical of the type of pure research which has done most to develop the science of geology.

Although geological work is an absolute essential to the ultimate delineation and utilization of mineral resources, it provides primarily an indication of location and occurrence. Mining exploration is therefore required to determine the extent and quality of the occurrence, and to chart the possibilities of and methods required for utilization. One of the major jobs undertaken by the Bureau of Mines in recent years has been exploration work on strategic and critical minerals.

During the war it was demonstrated that, in the case of certain scarce minerals, production does not always materialize in times of stress even though the location of low-grade deposits is known and cost is a secondary consideration. Dangerous delays, and sometimes insurmountable obstacles are encountered if proper ground work has not been laid. In the case of deposits of low-grade or complex ore of minerals that may be needed in time of emergency, it is essential to have methods of mining and treating the ore worked out well in advance. The lag between the time of preliminary investigation of a deposit and the beginning of actual production, even in the case of immediately commercial deposits, often runs into years. This lag cannot be sufficiently telescoped in time of emergency to make up for lack of painstaking development work.

The broad objectives of the program are to improve the country's internal position regarding strategic and critical minerals. However, it is not considered to be the function of the Bureau of Mines to perform work in development that would otherwise be done by private enterprise.

During the eight fiscal years from July 1939 until July 1947, more than 9,000 engineering examinations were made, about 1,000 development projects were conducted, many miles of trenches were dug, hundreds of thousands of feet of holes were drilled, tens of thousands of samples were analyzed, and hundreds of beneficiation tests were performed by the Bureau of Mines. As a result of this work, millions of tons of ore of valuable metals and minerals of both commercial and marginal grades were developed. A considerable fraction of this ore was mined by the industry and used in the war; the remainder is known to be available when or if it is needed.

If we are to be prepared for a national emergency, we must have a virile and thriving mining industry, and in addition we must stock pile quantities of strategic and critical metals and minerals to tide us over the period of gearing our industries to emergency levels. If we are to be able to speed up our production of metals and minerals to emergency levels, we must have, in addition to stock piles, an adequate supply of known domestic deposits of every strategic mineral it is possible to find. If there are none to find in some commodities, we must know in advance so that additional stock piles or substitutions may be provided.

In the postwar period the maintenance of high levels of industrial activity in the face of shortages in mineral supply, the increasing dependence on foreign sources for minerals, and the great importance of the United States in international affairs, emphasize the necessity of adequate up-to-date information on mineral developments throughout the world. Improvements in statistical methods developed as a result of war experience and well-established statistical and economic services on bituminous coal should be retained for the benefit of all industry and the Government in possible future crises when such information is esesntial in dealing effectively with mineral shortages.

Collection of basic facts as to the uses of strategic and critical minerals and the quantities on hand in industry that can be counted on as a strategic stock pile are of great value. Expansion of the fact-finding program abroad in cooperation with the Department of State and the Central Intelligence Group is also needed. These data are required in connection with market analysis for stock pile procurement, national defense planning, and planning the development of domestic marginal and unused mineral resources.

Utilization Techniques

Two developments are forcing the United States to consider intensively the problem of using its metal resources more efficiently. A number of high-grade ores once found abundantly in this country are rapidly becoming exhausted, and, at the same time, specifications for finished products made from these metals are becoming more exacting in order to meet new conditions under which they are used. Such conditions are operating under much higher temperatures, heavier loads, high electrical and corrosion resistance, and greater mechanical stress.

We have learned how to make many metals more resistant to such conditions through the use of alloys and heat treatment, and are developing new metals. In participating in the effort to meet this challenge to our mineral and industrial supremacy, the Bureau of Mines is charged with a heavy responsibility.

Over 100 projects dealing with mineral products are under investigation by the Bureau, most of which have a direct bearing on the utilization of domestic raw materials vital to full employment and continued prosperity.

This Nation still possesses immense known resources of medium- and low-grade ores of certain minerals. While it is the work of the Geological Survey to add to these reserves, the Bureau of Mines is largely concerned with the economic utilization of such deposits, largely through improvements in methods of beneficiating lower-grade raw materials, better metallurgical practice, the development of new processes and the recovery of marketable byproducts.

In work of this kind, it is not always enough to establish fundamental principles and laboratory technique. New and improved processes must sometimes be demonstrated on a pilot plant scale and each step systematically developed. Where there is no apparent promise of early reward to industry to warrant private business investing funds, and especially where national security is the primary object, Government must undertake pilot plant operations and demonstrate the practicability of new and improved processes.

Such investigations not only are of paramount importance to our national security, but are an important contribution toward stabilization of our peacetime economy. Sudden cessation or drastic curtailment of such work would mean sacrificing a vast stock pile of accumulated knowledge and money already spent on pilot plants that are either operating or in the course of construction.

In spite of the limited funds available for metallurgical research, the Department's accomplishments have been notable. Stronger and more durable steel alloys have been produced meeting rigid specifications; high-grade sponge iron has been manufactured from various types of ore by several different methods, and this product has proved a technically satisfactory substitute for scrap iron in open-hearth steel furnaces, although its adoption by industry will depend upon comparative costs of other methods.

Basic investigations are being conducted to establish the conditions under which sulfur can be best eliminated from metal products and the knowledge thus gained should make for better metallurgical practice.

New structural metals have been added to supplement those long in use which are now in dwindling supply.

Electrolytic manganese, chromium, and cobalt are being produced from domestic raw materials. Titanium and zirconium, two metals having unique and valuable properties, are being manufactured on a substantial scale by processes worked out in the Department's laboratories and pilot plants.

Large samples of these metals are being distributed to industry to establish the uses for which they are best adapted. The demand is far greater than the supply, better industrial acceptance and lower-cost production methods can be obtained with intensification of the present work.

The production of pure alumina from low-grade bauxite and clay both by alkaline and acid processes has proved technically feasible and while the cost so far is appreciably higher than that of producing alumina from high-grade bauxite, these processes may well prove invaluable in time of emergency.

Utilization of domestic deposits of magnesia-bearing minerals, such as magnesite, dolomite, and olivine for the manufacture of metallic magnesium, continued to receive the Department's attention, and methods of producing this metal and its alloys progressed in spite of curtailed funds.

The separation of both aluminum and magnesium from light-metal scrap is recognized as an important problem both from the standpoint of conservation and economy. The Department's work during the past year has pointed the way to a better utilization of the large tonnages of such metallic wastes.

The recovery of rare metals as byproducts of other industries is another problem investigated by the Department in 1946. New and important uses have developed for such metals as thallium and gallium, and a survey of possible sources as well as methods of recovery are being made.

Department investigations also disclosed the presence of appreciable quantities of vanadium in the phosphate-bearing strata of the Western States. From the standpoint of tonnage, the vanadium in these deposits represents the greatest known reserve in the world, and research work now being conducted indicates strongly that this critical metal can be recovered as a byproduct in the manufacture of phosphorus by the electric furnace process.

In the field of nonmetallics, the Bureau of Mines has also made much progress.

Lightweight products for concrete aggregate and insulation purposes have been produced from perlite, a volcanic rock of which the Nation possesses enormous quantities, and it has been shown that strong, light cellular building material can be obtained from many clays by mixing and heating them with small percentages of sulfur.

Research on the liquefaction of helium in commercial quantities was carried out for the purpose of transporting helium in the liquid form to reduce transportation costs. Studies were made of helium-shielded arc welding to improve the method for welding magnesium, aluminum, and stainless steel. This work will promote the so-called light metal era. The feasibility of welding titanium by the helium-shielded arc method was demonstrated.

The Bureau of Mines work in research and utilization of helium could be greatly increased with resulting benefits in improved methods of helium-shielded arc welding. The welding of titanium with the helium-shielded arc should be undertaken with a full program, as this metal recently has been made available through the development of a new production process by the Bureau's Metallurgical Branch.

The use of helium in welding zirconium should also be studied.

The Bureau should study the use of helium for degassing special steels used in the fabrication of gas turbines and jet engines for the purpose of improving the metal to increase the working temperature of the parts, and thus raise the efficiency of this form of power and locomotion that is being developed for power plants and aircraft.

As soon as sufficient quantities of liquid helium are available, research should be conducted to determine the physical properties of substances exhibiting superconductivity at liquid helium temperatures. No research on the medical use of helium has been carried out by the Bureau, but 16 possible respiratory applications have been suggested and should be investigated.

Health and Safety

The men who work in the Nation's mines are directly responsible for mineral production, and therefore their health, safety, and well being is absolutely essential to maintenance of production. Mining is hazardous work in spite of technological progress in the industry.

Since most of the problems are similar for various areas of the Nation, joint national attention is logical and desirable.

Conservation of life was recognized as one of the objectives of the Bureau of Mines when it was established in 1910. Coal mine disasters resulting in loss of both life and resources provided the primary impetus for organizing the Health and Safety Branch of the Bureau. Prevention largely by discovering the causes of mine disasters, devising means of avoiding them, and education of the industry has been the general method by which results have been achieved.

From 1906 to 1910, just before the Bureau of Mines got into action, 84 major disasters occurred in the coal mines of the United States, as compared with 26 from 1942 to 1946, the last 5 calendar years. This was a reduction of almost 70 percent. For the same periods fatalities in major disasters were reduced from an average of 477 a year to an average of 92 a year, a reduction of 81 percent. If the rate for 1906–10 had continued to the first of January 1947, the number of fatalities in our coal mines would have been almost 38,000 greater than they actually were.

With experimental data collected in its laboratories the Bureau has been able to render invaluable service that has helped to minimize explosion disasters. Files recording Bureau assistance, indicate that property savings have reached hundreds of millions of dollars.

In recent years there has been a sharp increase in industries employing hazardous and explosive materials. As the Bureau is the only civilian Government agency that has the facilities and experienced personnel for testing such materials, it is evident that until expenditures for such studies at an increased tempo are made possible, a potential hazard exists in countless industries, as well as in every populated area where explosive gases are handled and stored—hazards that are foreseeable and correctible.

At present, the large backlog of work of this nature in the Bureau of Mines is evidence of the degree to which outside agencies look to the Government for solutions of their safety problems. The awfulness of the Texas City disaster reminds one of the need for early action.

If more funds could be expended on the projects, much greater progress could be achieved in exploring the basic causes of the ignition of gas, vapors, dusts, and explosives, and of the means of preventing propagation of explosions, in studying ways of suppression of coal dust during the mining operations, in investigating the relative effectiveness of new rock-dusting materials proposed for use in coal mines, in developing effective fire-fighting techniques for incipient mine fires, which have resulted in many severe disasters, and in extending, correlating, and publishing the great fund of information gathered on explosion hazards of hundreds of industrial gases, vapors, and dusts.

Energy

Modern civilization measures its material progress in terms of energy consumption—there is no better index of economic stability and growth. It has become clearly evident that, as new sources of energy are harnessed, they do not necessarily displace previous and commonly accepted sources. In fact, the increasing total consumption of energy in the world requires a compounding of all economic energy supplies.

On a per capita basis, the United States continues to be both a fabulous producer and consumer of coal, petroleum, natural gas, and hydroelectric energy. All national trends are sharply upward for every kind of energy utilization with no indications in sight of any slackening of energy consumption in the home, on the farm, and in industry. These totalized demands are sufficiently great to cause severe strain on the Nation's present capacity to produce energy, which although greatly expanded during the War, is being fully utilized without providing allowance for reserves. The curves of production and consumption are coincident, and in some respects deficiencies are clearly in the making, if not already evident.

Nationally, reserves of coal and hydroelectric power have enormous potentials which assure abundant energy for generations. In petroleum, total demand is now outrunning available supply. The tremendous demands for oil and gas necessitate accelerated effort for the discovery of new fields toward production of liquid fuel from coal and oil shales.

If the United States is to maintain its preeminent position in the world and is to be of material aid in world reconstruction, its over-all energy plant must be expanded rapidly. With the exception of petroleum, the resource base—coal, oil shales, swiftly flowing rivers—is sufficient for many hundreds of years ahead. The immediate task is primarily one of providing capital investment on a sufficiently large and rapid scale to tap these resources on an efficient basis.

Petroleum

Petroleum presents the gravest problem encountered during the past calendar year—the first full postwar year. All records were broken for producing, refining, and distributing crude oil and petroleum products. More petroleum was produced, refined, and consumed in the United States during this period than during any preceding year—not excepting the war years—and demand for oil in the United States alone was greater than that of the entire world before the start of World War II. For the first time in modern peacetime petroleum history, the American petroleum industry found itself unable to meet in full the demand for its products.

The ability of the American petroleum industry to supply petroleum products in vast quantities, of ever-improving quality, and at prices within the reach of all, has been of decisive importance in the growth of American economic, industrial, and military strength. The present situation, therefore, demands careful attention.

The causes of this abnormal situation—inadequate supply despite record production—are twofold: The unprecedented increase in oil consumption and the critical shortage of steel which has prevented adequate and timely expansion of petroleum operations and facilities. There exists a staggering backlog of need for exploratory and development wells, gathering and trunk pipe lines, refinery expansion and construction, and distribution facilities of all kinds. The basic processing plant is substantially the same as prewar. During the war, the normal growth of this plant almost entirely ceased. The utilization of steel and other scarce materials, and of labor, was permitted only for activities which contributed directly to the maintenance of essential war activities. Generally speaking, the permitted expansion in oil industry facilities, such as those for the production of aviation gasolines, synethetic rubber components, and the like, although of decisive importance to victory, had little relation to the Nation's peacetime needs. Such war-born facilities as the "Big Inch" pipe line and the expanded barge lines, which now form a part of the industry's transportation system, fall far short of needed expansion of prewar facilities.

A free flow of steel is therefore basic to success in closing the gap which now exists between demand and the ability of the industry to supply petroleum products when and where they are required.

There is no certainty, however, that adequate steel supplies alone will solve the petroleum problem. Since 1938, new oil discoveries in the United States have not sufficed to meet the growing demand and to build up a reserve of excess productive capacity comparable to that with which we entered the war. Peaks and valleys have always characterized the record of oil discoveries in the United States, with alternating attitudes of optimism and pessimism as to our oil future. Certain disturbing factors of recent years merit close attention. More and deeper wildcat wells have been drilled, more geophysical crews have been employed, and more oil fields have been found, but there has been a sharp falling off in the average size of new fields discovered. This has the double effect of failing to maintain the ratio of supply to demand and of increasing the unit cost of finding oil. Another factor of significance has been the increasing proportion of gas discoveries instead of oil discoveries resulting from the drilling of deep wells, especially in the Gulf coast area.

Thus the Nation is faced with the critical question of its ability to continue to find and produce enough crude oil in the United States to meet the steadily rising rate of demand.

But, as a consequence of the high demand during and since the war, the Nation has now no reserve productive capacity of any significance. This fact is the most important difference between the prewar and postwar petroleum situations, both as to our general economy and our security. Forceful exploration and conservation are essential to provide as large a reserve capacity as it is possible to build, but it seems unlikely, at this time, that we shall soon again match the prewar figure of reserve capacity. The safeguarding of the petroleum future of the country requires, therefore, that while emphasizing exploration and conservation we look beyond them to other measures.

One promising possibility is secondary recovery, which depends on continued advancement in techniques of recovering the vast quantities of oil known to remain in fields whose primary energy drives have been exhausted. The study of methods to make that oil more readily recoverable demands the best scientific efforts of both Government and industry.

Synthetic Development

The synthetic fuels program now well started in the pilot plant stage, but with a long way yet to go, is another potentially great contributor to oil security. We must continue to increase our knowledge and experience in the development of methods of producing synthetic fuels. Already, the production of liquid hydrocarbons from natural gas appears to be economically feasible, and great plants employing this process are planned or under construction.

Significant moves have been made by industry in connection with such research and development. The Government is also conducting research and investigation in the production of oil from oil shale and the production of similar products from coal. The present effort is by no means of sufficient magnitude, however, even though notable progress is being made. The Bureau of Mines has been charged by the Congress with the responsibility for work on the production of synthetic liquid fuels from coal and oil shale. During the past year, this work has been intensified.

One of the authorized demonstration plants is already in operation at Rifle, Colo., producing up to 50 barrels of oil a day from oil shale. Another demonstration plant to produce 200 barrels of gasoline a day from coal by hydrogenation is scheduled for completion at Louisiana, Mo., by June 30, 1948.

In contrast with the rising costs of finding and producing natural petroleum, radical improvements in the synthetic processes promise marked reductions from previously estimated costs. For example, Bureau of Mines engineers have plans for an improved coal-hydrogenation plant with a calculated efficiency of 55 percent, as compared to 29 percent for a typical German plant. This improvement indicates a tremendous reduction in the quantity of coal required. However, proving of these advanced designs, and other new developments from the laboratories, undoubtedly will require additional funds and an extension of the time beyond the 5 years originally authorized.

One important draw-back is the fact that production of large quantities of synthetic gasoline and oil from coal will require considerably more manpower than is needed to produce and refine petroleum. Emphasis is, therefore, being placed on designing plants that require minimum labor. The importance of this program was recognized by the Independent Petroleum Association of America in its proposed national oil policy and by special petroleum committees of both the Senate and House in their final reports. Its importance in national defense has brought full cooperation of the armed forces in the Bureau's program.

In looking ahead, we must also take into consideration oil from foreign sources. Imports should not be so limited as to force operation of our domestic fields at levels which exceed the maximum efficient rate of operation and thereby cause physical waste. If this were to be the sole criterion, however, there would obviously be much less likelihood of attaining a reserve productive capacity. Moreover, imports should not be of such magnitude or character as to threaten the economic strength of the domestic oil industry.

The most prolific reserves would be useless if combined with an industry incapable of rapidly converting it to the needed products and delivering them to the points of demand.

Our present and prospective supply of crude petroleum, even when viewed with a full measure of optimism, does not afford such abundance as to warrant waste in production or use, if we are to protect adequately our oil and gas future. Vigorous exploration alone will not give us protection. An increasingly better job must be done in extracting oil and gas from underground reservoirs.

The development of techniques and the successful operation of pilot plants will give us a satisfactory start toward the solution of the problem of petroleum security through synthetics, but it does not, by any means, provide a complete answer to our petroleum problems. All indications are that large capital expenditures will be necessary and that a high rate of obsolescence for pioneer plants will coincide with advancing technology.

The present difficult supply situation emphasizes anew the necessity for protecting our safety and our economic welfare by bringing to bear upon our petroleum problems the combined brains of the Government and the industry. The machinery devised last year to this end has already proved its great and continuing value. Increasingly, the novel and complex petroleum problems of other Government agencies are being brought to the Interior Department's Oil and Gas Division. Increasingly, the Division, directly and through the National Petroleum Council, is enlisting the aid of the industry and of other Government agencies in solving these problems.

For decades many agencies of the Federal Government have been concerned with oil and gas matters, each with its own specialized interest in some restricted aspect of the vast and diversified economic organization that supplies our petroleum products, but none were charged with knowing the effect of its actions on other parts of the organization or on the public's over-all and paramount petroleum interests. Now, for the first time in our peacetime history, the Federal Government has an effective, functioning unit charged with knowing the public's interest in all parts of the organization, and with gaging the effect of each proposed governmental action on the organization as a whole and on its capacity and will to serve the public interest.

Now also, for the first time in our peacetime history, the Government has a permanent, advisory group representative of the entire petroleum industry, the National Petroleum Council, to furnish it information and to advise at its call. The data furnished to the Government by committees of the council during the past year could not otherwise have been obtained by the Government except at an expenditure many times the cost of the Oil and Gas Division. The knowledge and judgment made available to the Government through the council's quarterly meetings and the services rendered by the council in the solution of special problems could not have been had otherwise at any price.

Coal and Coke

Although the Nation possesses billions of tons of coal ranging from high-ranking types to the lignitic, there is no justification for waste. Certain types of coal, particularly those required for the production of coke, are essential to the manufacture of steel and many other extremely important industrial products. These are increasingly in short supply, and their conservation through improved utilization is of great national importance.

Depletion of high-grade coking coal reserves has progressed so far that many blast furnace and coke plant operators have been obliged to seek new sources of coking coal, and to use coals that by prewar standards were unfit for metallurgical coke use. One coal-washing study has shown the limitations of present techniques to improve a large reserve of high-sulfur coal comprising almost one-half of the estimated recoverable reserves of Pittsburgh-bed coal. Some of this coal can be made suitable for metallurgical use by washing, but the study indicates the need for more extensive research on preparation methods which will convert large reserves of low-grade coals into materials suitable for metallurgical use. Surveys at commercial coal preparation plants have been initiated to provide fundamental data on present preparation methods, and to indicate improved techniques that may result in better products, reduced operating costs, and reduction of the discharge of usable coal with the refuse. This study has shown that approximately 1,000,000 tons of coal could be saved each year at large mines operating in the Pittsburgh bed in western Pennsylvania by installation of salvage plants to recover waste now lost. This loss of $5,000,000 to $6,000,000 worth of coal in one area alone is several times the Bureau of Mines' appropriations for research work on coal.

Research on combustion of fuels is directed toward substitution of lower-grade fuels for steam and power plant use to conserve high-grade coking coals for metallurgical use, and on improved combustion efficiency to provide heat and power at minimum cost from all types of equipment from the domestic furnace to the large utility power boiler. Basic research in this field by the Bureau of Mines has resulted in saving more than $10,000,000 annually in Federal plants alone, and vastly greater savings in private industry. Studies on the drying, gasifying, and combustion of the low-rank lignites and subbituminous coals are developing information on more efficient methods of utilizing these fuels which comprise about 42 percent of our known energy reserves, but only about 3 percent of present production. Removal of 10 to 20 percent of moisture from these fuels results in proportionate reduction of freight rates for a given energy value shipped. Boiler efficiencies are greater with the dried fuels.

In man's ever-increasing search to cut down the expenditure of human energy in the struggle for survival, the possibilities of utilizing coal's energy directly from coal beds have always intrigued the imagination. The sociological problems involved in the coal-mining industry are not passing ones—the dangers, the attendant discomforts are archaic in a modern age. Although progress has been made by increasing mechanization and improved working conditions in most mines, the over-all impact is still negligible as measured against the dilemma of the coal industry, its labor and its management.

One possible avenue for solution of the major problems of coal utilization is through the gasification of coal seams. This involves the release of the latent energy of such seams by controlled underground combustion. This method has important possibilities in the production of synthetic liquid fuels, for electric power generation and for supplementing natural gas supplies.

During 1947, the first large-scale trial of underground gasification in the United States was conducted at Gorgas, Ala., by the Alabama Power Co. and the Bureau of Mines. Other tests are scheduled by both industry and the Federal Government. From these, it will be possible to determine the efficiency and economics of such energy production from various types of coal seams, and to chart areas of the Nation in which gasification might provide additional and economical sources of energy. If feasible, gasification may ultimately make possible the use of energy from coal beds where ordinary mining methods would be unsound. The net effect of large-scale gasification on the extension of the national energy reserves would be immense.

Electric Power

Reflecting America's upward surge of energy consumption are the statistics of the electric power industry—public and private. Between 1940 and 1946, the total production of electrical energy in the United States increased 48 percent—from 186,000,000,000 to 275,000,000,000 of kilowatt hours.

Although the production of power-consuming devices for home and industry has not yet caught up with the demand for many of these devices, there has been a marked increase in the use of electric energy since the end of the war. For example, the average use for domestic customers for the calendar year 1946 was 1,329 kilowatt-hours, which was 8.15 percent, or 100 kilowatt-hours, greater than for the previous year. This increase in usage may reasonably be expected to continue for some years to come.

The increase in number of customers has been comparable to the increase in use per customer. At the end of December 1946, there were 36,140,291 ultimate customers of all classes representing an increase during the year of 2,109,218 customers, or 6.2 percent. Commercial and industrial customers were up 6.7 percent and residential 5.9 percent, but the greatest increase of all was in the number of rural customers which increased 11.9 percent.

The noncoincident peak demand on generating plants of public utilities in 1946 was 45,000,000 kilowatts, up 4,350,000 kilowatts from the previous peak which occurred in 1944. Compared with this increase in demand is the 1,115,000 kilowatt increase in capacity during the same period. The spare capacity on the previous peak was 8,539,000 kilowatts, or 21 percent, whereas in 1946 this had dropped to 5,304,000 kilowatts, or only 12 percent, a dangerously small margin, even if all of it were available and applicable to points of greatest need.

The appetite of the American public for electric power-consuming appliances, the increasing dependency of national industry on electric motors and related electrical devices, and the amazing growth of electroprocess plants for the production of light metals, electrochemical and electrometallurgical materials are so compounding and multiplying the demands for kilowatts and kilowatt-hours that the Nation faces an immediately serious problem of maintaining capacity to produce on an even basis with consumption. It seems likely that the extraordinary level of 275,000,000,000 kilowatt-hours consumption of 1946 will rise to about 376,000,000,000 kilowatt-hours in 1952. This would represent an increase of 37 percent over 1946 and a doubling of 1940 levels. In terms of capacity to produce these billions of kilowatt-hours, it will be necessary to expand the Nation's kilowatt generating capacity from an existing 57,000,000 to about 67,000,000 in the next 4 to 5 years.

Despite the continued efforts of the utility industry, public and private, and of the suppliers of materials and equipment, the power situation is expected to remain serious for several years. In some areas, at the present time, new customers cannot be connected, and increases in loads of present customers cannot be permitted. There are even some areas where all of the present requirements of existing customers cannot be supplied. Such shortage areas occur particularly in the Western States.

Actually there is very grave doubt that the manufacturing capabilities of electrical equipment manufacturers—for the fabrication of generators, water-wheels, transformers, and the like—can do much more than keep up with the demand for replacement of equipment and a relatively small amount of machinery for new installations. In addition, the curtailment of Federal programs for the completion and construction of dams for the byproduct generation of electric power provide another element of doubt and concern. The situation occasioned by this growing deficiency of primary electric power capacity will have serious repercussions on America's capacity to produce and conserve. It will bottleneck the natural growth of consumer demands for labor-saving electrical devices, and will adversely affect the entire economy of certain sections of the Nation such as the Pacific Northwest.

Although a major portion of the electric utility production capacity of the United States is dependent on fuel-fired generating plants, about 30 percent is in hydroelectric installations. Their importance, however, is far greater than the indicated percentage. Hydroelectricity is restorable and wherever possible should be substituted for expend-able sources, particularly petroleum and natural gas which must be reserved for automotive transportation and for the chemical industry. Then, because of the peculiar requirements of electroprocess industries for extremely low-cost and huge blocks of dependable electricity, hydroelectric power must be developed in expanding quantities to assure the future progress of these industries. Unless additional domestic hydro is provided at the maximum rate permitted by fabricating facilities for water-wheels and generators, the production of materials essential to the expansion of the Nation's industrial economy—such as aluminum, magnesium, plutonium, phosphorus, ferroalloys and many others—will be seriously and perhaps irretrievably bottlenecked.

In addition, hydroelectric power provides a financial springboard for the multiple-purpose projects required for flood control, the improvement of navigation and the development of irrigable lands. In the auspicious beginning which has been made toward securing the full benefits of the Columbia, the Snake, the Sacramento, the Colorado revenues from power sales have more than carried their legal obligations for the repayment of project costs.

Irrigation costs are fully reimbursable, but there are few, if any, irrigation projects remaining to be developed in which the water users will be able to pay the full irrigation costs. The irrigation costs in excess of the water users' payments must be paid by power as flood control and navigation costs are not reimbursable.

Even where there is no such subsidy, it is only through the reduced costs that result from a dam constructed for more than one purpose that irrigation costs are brought within the ability of the water users to repay or that flood control or navigation costs are brought within the amount of the economic benefits and the projects thus made feasible. There are few important flood control or navigation projects which could be financially justified on a reimbursable basis, if it were not for the power which is developed as a byproduct. All investment costs charged to power are recovered with interest on the unpaid balance from power revenues.

The availability of low-cost hydroelectric power has made possible the establishment of numerous large industrial plants in the West, furnishing an important and expanding base for the creation of taxable wealth and gainful employment. The national urgency for providing opportunities for the rapidly growing population of the Western States therefore points to the facilitating benefits of byproduct hydroelectricity.

With the exception of the power from the Tennessee Valley Authority projects, the Department of the Interior is responsible for marketing virtually all hydroelectric power developed at Federal water-control projects. The vesting of this responsibility in the Department is the natural outgrowth of its long experience in marketing power from projects which it constructed and operated, when they were the only important Federal power developments.

The Bonneville Dam on the Columbia River between Oregon and Washington was the first War Department project from which the Department of the Interior was given the responsibility for power marketing.

A Bonneville Power Administration was created by statute within the Department in 1937 for this purpose. Since it possessed transmission lines in Washington and Oregon it was later designated as the marketing agency for power from the Bureau of Reclamation's Grand Coulee Dam on the upper Columbia River in Washington. It has also been designated to market power from the War Department's McNary Dam on the Columbia River between Oregon and Washington and Snake River Dams in Idaho, and the Bureau of Reclamation's Hungry Horse Dam on the South Fork of the Flathead River in Montana.

Fort Peck Dam on the Missouri River in Montana was the second War Department dam from which the power was turned over to the Department of the Interior for marketing, under the provisions of the Fort Peck Act of 1938, which specifically placed this responsibility with the Bureau of Reclamation.

During the war, the operation of the Grand River Dam on the Grand River in Oklahoma was, by Executive order, taken over by the Federal Government and responsibility therefor placed with the Public Works Administration. In 1943, by Executive order, this responsibility was transferred to the Department of the Interior which established the Southwestern Power Administration to perform this function. The Southwestern Power Administration was also entrusted, by Executive order, with the marketing of the power from the War Department's Denison Dam on the Red River between Oklahoma and Texas and the Norfork Dam on the North Fork of the White River in Arkansas. After passage of the Flood Control Act of 1944, section 5 of which placed the responsibility for the marketing of power from all War Department reservoir projects, heretofore or hereafter constucted, with the Department of the Interior, the Southwestern Power Administration, by departmental order, was made responsible for marketing power from any of these projects located in Arkansas and Louisiana and parts of Oklahoma, Texas, Missouri, and Kansas, including the Denison and Norfork projects. The Grand River Dam project was returned to the Grand River Dam Authority, an agency of the State of Oklahoma, on September 1, 1946.

The Bureau of Reclamation markets the power from its own and all War Department projects west of the Mississippi River, excep from those in the marketing areas of the Bonneville and the Southwestern Power Administrations. At this time, the only authorized War Department project from which the Bureau will market power will be situated in the Missouri Valley and in the Central Valley of California. The arrangement whereby an agency of the Department of the Interior markets power from both Interior and War Department projects is particularly appropriate in these areas, as it is in the Columbia Basin, because of the interrelationship of the projects. In all of these areas it would be impossible to obtain the full potential benefits on any other basis.

In the area east of the Mississippi River and mainly south of the Ohio River, a number of War Department projects have been authorized. A group of eight projects are authorized for construction in the Cumberland River Basin. These projects are so situated as to belong naturally on the system of the Tennessee Valley Authority. Accordingly, the Department of the Interior has reached an understanding with the Authority whereby the latter will handle the actual marketing of the power from these projects. The other authorized southeastern projects are located in basin draining into the Gulf of Mexico and the Atlantic Ocean. This area has been well covered by War Department investigations, and nine projects have been specifically authorized. There is also a blanket authorization for development of the Alabama-Coosa River system. River basin developments have been approved in the Apalachicola, Savannah, and Roanoke Basins, and developments have been investigated and found feasible in the Santee and Pee Dee River Basins which would be desirable for flood control and navigation. The proposed developments will constitute a compact and well-spaced group of projects which ultimately should be interconnected in order that the greatest possible benefits may be derived from the power generated at these federally constructed dams.

At the end of the fiscal year, there had been authorized for construction by the Bureau of Reclamation and the Corps of Engineers projects having an ultimate capacity of 14,100,000 kilowatts. Of this, 2,971,000 kilowatts were in operation and 3,296,000 kilowatts were under construction. In addition, there are many projects in river-basin development plans which have been approved and others which have been investigated and found feasible but as yet have not been authorized or approved. In the Southeastern States alone, there are 1,094,000 kilowatts in approved projects and 880,000 kilowatts in feasible but unapproved projects included in recent investigations made by the Army Corps of Engineers. There are also uncounted kilowatts of potential feasible power in streams which have not been completely investigated and in streams where partial developments for flood control alone have been made without taking advantage of the full potentialities of the streams for power developments.

Plans of the various marketing agencies contemplate the construction of backbone transmission systems in each area interconnecting the various Government plants through the load centers and connecting to the existing utility system in the area. Such systems cannot in any sense be considered as duplicating lines of existing systems. They will serve an entirely new function of tying together all of the power resources of a large area and permit the transferring of blocks of power to best suit the market conditions. They will also play an important part in making this power immediately available for national defense purposes as well as for any other Federal needs.

The program of the Department thus recited depends on the rapidity with which necessary funds are obtained, how fast manufacturing capacity can provide turbines, generators, and electrical equipment, and how quickly new dams can be constructed. The immediate future ability of the Department's power agencies to meet current power demands must also reflect the fullest and most effective utilization of existing facilities and those which can be brought into production most immediately. By this token, therefore, all devices employed during the war to coordinate electrical operations and to gain energy and capacity are being continued. Arrangements have been made, wherever feasible, for relaying excess power from one area to another, although this excess power may not be available continuously. All the advantages of integrated system operations are being employed to the limit in every marketing area of the Department.

The Department's program is designed to improve the power situation in the Northwest through the installation of additional generators at Grand Coulee and the construction of the Hungry Horse project on the headwaters of the Columbia River in Montana and the Anderson Ranch and Palisades projects in Idaho. Also, power from the War Department's McNary Dam, now under construction on the main stem of the Columbia River, will substantially increase the power available for sale by the Department. Davis Dam, on the Colorado River, will afford partial relief in Arizona and adjoining territory in Nevada and California. In the Missouri River Basin the Bureau of Reclamation now has under construction two Colorado-Big Thompson plants in Colorado and the Boysen, Kortes, and Heart Mountain plants in Wyoming, while the War Department is constructing the Garrison project in North Dakota and the Fort Randall project in South Dakota. In California, the Keswick plant is nearing completion, and three units are being added to the power plant at Shasta Dam. The Department's system in the Gulf Southwest will be supplied by the additional generators being installed at the Denison and Norfork power plants and from the Bull Shoals, Narrows, and Fort Gibson projects now under construction, all by the War Department. Power from the Allatoona, Buggs Island, Clark Hill, and the Cumberland River projects will add needed capacity in the Southeast.

Indian Resources

The American Indian and the resources to which he has inviolate right are a potentially rich part of the Nation's capacity to produce. For instance, of the more than 56,000,000 acres of tribal and individually owned land, 3,000,000 acres are classed as agricultural, 16,000,000 as forest, and 32,000,000 as grazing. A rough value for this land, its improvements and timber is placed at almost $400,000,000 to which must be added Indian livestock valued at $40,000,000 and an undetermined amount for mineral deposits which are contained in the Indian lands. As an indication of the value of their minerals, an annual income of almost $7,000,000 was produced in the last year. With the imminence of establishment of a full-scale phosphate industry in the West which would draw a portion of its requirements for rock phosphate from Indian lands, this income should be increased substantially. Improvements of the Indian estate by the Federal Government in the discharge of its trusteeship responsibility can be estimated at $177,000,000 for buildings and structures, roads, and irrigation works.

This physical plant can carry its proportionate share of the national production. Its potentialities for providing an increasing degree of well-being for the Indian population have barely been tapped. The key to the achievement of a balanced contribution by the Indians and their resources is the degree to which the Federal Government through the Department of the Interior's Bureau of Indian Affairs can assist the Indian to develop his resources on a sustained-use basis and to transfer to the Indian, as rapidly as he is willing and able to assume it, full responsibility for management. That progress is being made is demonstrated by the fact that for the first time since Indian relations under the Constitution were made a Federal responsibility, the resources of the Indian people have been stabilized. Their land holdings for the first time are increasing rather than decreasing. But the goal is still a distant one, and the intensity and magnitude of the overall effort must be sharply increased.

The Indian population is predominantly rural. The 1940 census returns showed that only 9 percent of all Indians enumerated were living in urban areas. The situation with regard to employment revealed a similar concentration: 30 percent of all Indians were listed as farmers or farm managers; 22 percent as farm or other laborers; and 18 percent were employed by CCC, WPA, and other emergency activities in rural areas. Any population so situated obviously must look to the land for its security.

It is estimated that 44,000 Indian families, or slightly more than one-half of the Indian population, derive their income in whole or in part from agricultural pursuits. The income derived from agriculture in 1946 was estimated at $40,000,000, or approximately $918 per family. This compares with a national average in 1945 of $2,541 per non-Indian farm operator.

To understand these Indian averages, it should be explained that agricultural extension work was not organized among the Indian people until 1930. Even after its organization, the work was hampered by lack of staff, a condition which still exists. In 1932, Indians owned 170,800 head of beef cattle and 11,300 head of dairy cattle. The income from all livestock operations in that year amounted to $1,300,000. By 1946 the number of beef cattle owned had increased to 382,300 head and dairy cattle to 50,000 head. Income from livestock in 1945 amounted to $21,000,000.

This rate of increase is encouraging, but the distance still to be covered is reflected by the following facts: Indians owning beef cattle in 1946 number slightly better than 16,500, yet the population of the predominantly grazing reservations amounts to 200,000. As to the lands classed as grazing (including timber and woodland), Indians today are using approximately 35,000,000 acres out of a total of 45,000,000. This area, if it could be brought into Indian use by making available credit and other facilities, would permit the Indians to increase their livestock holdings by better than 300,000 head. This stock, on the basis of 60 breeding cows per family, would give an average income of $1,200 to about 5,000 families.

A somewhat comparable situation exists with regard to the use of agricultural lands. In 1932 the Indians were reported using slightly over 500,000 acres in growing field crops and gardens. This acreage had increased to about 900,000 acres in 1946, but even this left 1,800,000 acres in non-Indian operation. The value of sales from crops production in 1946 amounted to $7,688,500 an average of $8.50 per acre. If the same rate of return were realized, as on the lands in non-Indian use, the Indians would increase their agricultural income by more than $15,000,000. On the basis of $1,200 per family, 12,500 additional families would benefit.

Similar parallels could be cited with respect to the use made of, and income derived from, the forests and mineral deposits on Indian lands.

The greatest single factor responsible for Indian use of resources is the revolving credit fund authorized by the Indian Reorganization Act of June 18, 1934. The first credit appropriation was made

July 1, 1935, and appropriations to date amount to a total of $6,600,000. Money repaid into the fund becomes available for further loans. Altogether $12,927,290 has been loaned in cash since the program was inaugurated. The effectiveness of the program, from a banking point of view, is indicated in the delinquency rate. Of $5,630,737 which was due in 1947, only $18,925 was written off, or less than 0.3 of 1 percent.

Supplementing these cash loans, the Indian Service has a revolving cattle pool which started with breeding cows obtained in 1934 and 1935 under the drought-relief program. Altogether, a herd of 42 head, was obtained and distributed to loan clients who repaid in kind. Up to the present, a total of 122,750 head has been loaned to Indians.

How the Federal Government may remove itself as trustee over Indian property and how it may discontinue the services which it now provides are questions requiring the most careful examination. With its plenary power in matters affecting the Indians and their property, the Congress could at any moment withhold all appropriations for Indian administration and it could remove all trustee safeguards now in force. Entirely apart from the injustice which such precipitate action would inflict on these first Americans, whose property rights do not derive from any benevolence of the United States, it would prove economically disastrous to reduce the resources available to the Indians.

In testimony before the Senate Civil Service Committee in February 1947, an attempt was made to suggest a fair and equitable basis upon which the the Government might measure its responsibility toward a tribe and so determine when it might withdraw as trustee. Four factors were suggested: (1) The degree of assimilation of a tribe, as indicating aceptance by the Indians of white habits and acceptance of the Indians by the white community; (2) economic condition of a tribe, to indicate a reasonable possibility of gaining a livelihood through the use of available resources; (3) willingness of the tribe to dispense with Federal aid and guidance, and (4) willingness and ability of States and communities to provide public services.

The testimony further indicated that, on the suggested basis of judgment, certain tribes and groups were at the point where, at an early date, if not in all cases immediately, Federal supervision could be curtailed or eliminated. For a second list of tribes, a somewhat longer period of adjustment and preparation was indicated. Finally, as to certain tribes and groups, where conditions with respect to all four factors were unfavorable, continued Federal assistance for an indefinite period seemed unavoidable.

Whether these are the proper factors to consider, or whether they are the only factors that need to be considered, is immaterial at the moment. It is certain, however, that only through such a procedure of measuring accomplishment and estimating needs can the Federal Government discharge its responsibility with any degree of satisfaction.

In the report, reference is made to legislative proposals in the first session of the Eightieth Congress to remove restrictions against the alienation of Indian lands, to make these lands subject to taxation, and to throw the allotted Indians upon their own resources regardless of their readiness for such a move. These proposals have had a disturbing effect. To the extent that they reflect impatience with the rate at which the Government is achieving solutions for the many problems facing the Indian population, they have validity. Granted, perhaps, that the rate of progress has been slow, it nevertheless follows that we get ahead no faster if we reduce our present effort. A hungry and sick Indian is not brought nearer to the day when he may have food and good health if we allow his meager resources to be further diminished or wasted.

The Alaska Frontier

The territories and island possessions of the United States present a wide range of opportunities for the expansion of national production and as wide a range of problems toward the conservation of resources. The kaleidoscopic variety of challenges to the ingenuity of both Government and private enterprise are exemplified by the contrast between the vast and grossly underpopulated area of Alaska and the small densely peopled acres of Puerto Rico, of the Arctic conditions of much of Alaska, and the tropical lushness of Hawaii. Sharp as these physical differences may be, the canvas of development is the same: The blending of resources for the creation of opportunity for people. The effort of the Federal Government, primarily residing in the Department and coordinated through its Division of Territories and Island Possessions, is of primary importance until such time as self-responsibility through statehood can be achieved for at least Alaska and Haiwaii.

For many years, the tremendous possibilities of development in Alaska have been recognized; but problems such as transportation, establishment of year-round industries, interesting new capital, and providing competition without dated established interests, have combined to erect barriers to the expansion of population which the territory should have. The foundation for realizing the full potentials of Alaska is to be found in providing a free and competitive atmosphere for private enterprise—large or small.

Alaska's three basic present industries, built upon its natural resources, are commercial fishing, mining, and the taking of furs. Potentially, it has at least two other important resources which can be developed to rival and surpass the importance of the first three—timber and tourist attractions. The imminent development of these does not detract, however, from the necessity of a correlated expansion of Alaska's agricultural lands and its energy resources. With these basic resources it will be possible to compound the opportunities for the ultimate population required.

Although for years, the appetite of the Nation's lumber industry has been whetted by the immense forests of southeastern Alaska, year after year, millions of board feet of timber ripened, decayed, and died. Conscious of this loss, the Territory through its officials and those of the Forest Service, sought interests to develop wisely this latent economic resource.

Today, Alaska stands on the threshold of one of its most important developments—the establishment within 2 or 3 years of possibly three large pulp and paper plants, guaranteed perpetuity of supply through sustained yield.

This could provide a doubled or tripled population for southeastern Alaska and, ultimately, as much as 25 percent of the entire national requirements for pulp and paper. A major obstacle to pulp plant investment was the so-called "Indian possessory rights," the restrictive requirements of which, in large measure, were overcome by legislation passed in the last session of Congress.

The requirements of these pulp and paper plants for pure fresh water and large quantities of electrical power have drawn considerable attention to the hydroelectric potentials of southeastern Alaska. The physiographic and climatic conditions of this area are not unlike those of Scandinavian countries—deeply indented fjords, high mountains, and innumerable torrential water courses, fed by a very heavy precipitation. Thus, last year, the Federal Power Commission and the Forest Service jointly completed a study of potential hydro sites in southeastern Alaska. The principal purpose was one of determining whether low-cost electric energy could be made available to potential pulp and paper plants, and to other types of power-consuming industries feasible of ultimate establishment.

Although only 10 percent of the area was surveyed, 200 power sites were listed with a total estimated firm capacity of 590,000 kilowatts and an average capacity of more than 750,000 kilowatts. A group of some 27 projects, with individual average capacities of more than 7,500 kilowatts, have a firm capacity of 335,000 kilowatts and a total average of 398,000 kilowatts. Studies remain to be made of construction costs and consequently of rates for which energy could be delivered to the consumer. If power can be produced at wholesale rates comparable to those of the Pacific Northwest, its availability in time can be an important factor in the establishment of nationally important electroprocess industries.

The possibilities of water-power development in southeastern Alaska, and the industrial requirements of the Territory as a whole draw attention to its mineral resources. Because, traditionally, gold mining has been the alpha and the omega of the mining industry in the Territory, its vast potential in the field of less noble but extremely important industrial metallic and nonmetallic minerals is yet to be appraised in even the most rudimentary fashion. The effort of Government towards a bare start in geological and mining reconnaissance can only be termed as pitifully inadequate. Of course, gold mining—which the war disrupted seriously—can be expected to continue in relative importance. At the moment, however, the gold-mining industry has not resumed operations to the scale of prewar production. The needs for the development of small mineral industries—such as for the supplying of construction materials desperately needed in the Territory—will remain unsatisfied until such time as geological and mining investigations can reveal the raw materials which can sustain even moderately scaled operations by private capital. The possibilities for securing substantial sources of critical and strategic minerals in Alaska will be unknown so long as exploration is conducted on the present miserly pattern. In this respect, an object lesson exists in a comparison of the magnitude between the geological programs of the United States and those, reported in Congress, of the Soviet Union.

The bounties of Seward's "icebox" in terms of fish, fish products, and furs have been fabulous. The potential is yet greater. Alaska's fisheries, yielding an average of $60,000,000 annually, is the Territory's main source of revenue. The yield in the last fiscal year was just under 4,000,000 cases of salmon, considerably below the normal pack of from 5,000,000 to 6,000,000 cases. While development of this industry is largely confined to southeast Alaska, southwest Alaska, and the Bristol Bay area, its probable expansion appears to lie in the Arctic. Some exploratory work has been done in this region north of Bristol Bay, but not yet sufficient to assure commercial activity. While the presence of sizable runs of fish is indicated, there is need for more study, particularly by the scientists of the Fish and Wildlife Service. Adequate funds to explore fully these possibilities might mean the addition of many millions in yield to the Alaska fishery.

While the canning of salmon continues to be the major processing activity in the fishing industry, plants for smoking salmon and other fish are beginning to appear. These small establishments, often operated as hand-packing units, are doing much to give a greater spread to the industry.

Strangely enough, the fishing industry has much bearing on the continued development of Alaska's fur activities. Revival of fur farming in the Territory offers an important opportunity to improve its economy. Fur farmers, who operated to some extent prior to the war, learned that one of the basic foods of pen-raised mink, fox, and marten was the waste from fish canneries, such as heads, tails, and entrails, all of which is now thrown away. It can be had at the canneries for the taking. The one important barrier to revival of this industry is transportation. Steamship companies have refused to take live animals aboard their vessels, with the result that the exchange of breeding stock between Alaska and other fur-raising areas has been curtailed sharply. The cost of air transportation in this instance is prohibitive.

In the taking of wild fur, the Alaska Game Commission and the Fish and Wildlife Service has carried on a careful conservation program, closing certain areas where it has felt that the take has been too heavy to assure continued supply.

The fur industry in the Territory yields about $2,000,000 annually. In addition, the average annual value of fur seals taken from the Pribilofs is approximately $1,000,000.

Perhaps no other natural resource of Alaska offers as great a challenge to the imaginative exercise of private enterprise as its tourist attractions. Alaska is a land of rare natural beauty. From its rugged, mountainous coastal area to the valleys and tundras of the interior, it has allure for travelers. In its heart stands Mount McKinley, 20,300 feet, highest peak on the North American continent—a challenge to mountain climbers the world over. Less than half-a-dozen parties have scaled it, although many attempts have been made. Perhaps nowhere in the world can the sport fisherman find such variety and abundance of angling. In Russian River, Illiamna Lake, and Naknek are the largest rainbow trout in the world. In its lakes and streams abound the cutthroat, greyling, the salmon, the Dolly Varden, and many other varieties of game fish, such as the famed Shee fish of the Kobuk.

To the big-game hunter, Alaska is a trophy land. There are found the great Kodiak brown bear, largest carniverous animal in the world, the great-horned Dall and Stone sheep, the crag-clinging mountain goat, the Arctic polar bear, the Sitka deer and moose of the Kenai Peninsula, from where has been taken the largest spread of moose horns on record. In the mighty valley of the Yukon the traveler may see the great annual migration of the caribou spreading for miles. The sportsman, the mountain climber, the camera enthusiast, the student of flora and fauna, all can fulfill their desires in Alaska.

However, this potential will remain unrealized until the present scarcity of tourist accommodations and facilities is overcome. With few notable exceptions, the traveler is catapulted within a few minutes from the luxuries of modern transportation to rudimentary living quarters frequently lacking the barest of essential comfort. This is a paradoxical situation because the rapid and well-developed facilities of air transportation make all of Alaska easily accessible, and steamship schedules continue to furnish a means of communication between coastal points.

What Alaska needs—to provide a major opportunity for an expanded population—is a great number of both small and large lodges strategically situated over its vast expanse. The current capacity of transportation facilities—air, bus, and steamship—is far in excess of existing accommodations, no matter how primitive. Given a network of adequate hotels, lodges, and camps, the tourist business would expand to a major industry with an income running into the millions and providing substantial employment. Alaska is a long way from the populated centers of the west coast and of the Nation in general. It has no connecting railroads, its highway system is subject to rigorous climatic conditions. Although the airplane is a principal pipe line, the development of industry and of the Territory does and will depend on adequate and reasonable water transportation. So far, it can be concluded that Alaska has not had that type of transportation. Three steamship lines operating out of Seattle share the Alaskan traffic. Tariffs increasing rates an average of 65 percent on most commodities were published even though the lines received a strong subsidy in use of Government-owned freighters at $1 per year and other benefits. Alaskans found living costs mounting to an all-time high; but even with this subsidy, shipping is inadequate. Most of the vessels are of the freighter type. Passenger accommodations are limited to half-a-dozen vessels. Southeast Alaska has once-a-week service from Seattle and service to westward Alaska is even worse. Whether or not current rates and services are justified, it is clear that adequate and reasonable water transportation is intimately connected with industrialization. Seasonal traffic occurring in alternate directions will always handicap growth of sound traffic and inhibit service at low rates. Costly winter lay-ups for vessels could be minimized with full-time local industries.

Hawaiian Development

Undeveloped agricultural, forestry, and fishery opportunities in the Territory of Hawaii have been studied since the end of the war with a view to strengthening and expanding the economy of these islands. While experimentation will be necessary before the practicability of projects under study can be determined, preliminary work indicates that a much more extensive development is possible than any which has yet occurred.

The soil and climate of Hawaii remain its most important resources. Farsighted planning by the sugarcane and pineapple industries have caused to be set aside from 1½ to 2 percent of gross earnings for research into more efficient use of the land and its products. Government agencies are engaged in research which will promote more extensive use of lands not suitable for the two primary agricultural enterprises. Expenditures for research amount to more than 3 percent of the gross territorial earnings from livestock, truck, and fruit crops, coffee, and other miscellaneous farm enterprises.

One of the most promising possibilities for improvement in Hawaiian agriculture appears to lie in irrigation development, which would increase acreage as well as the yield of land now under cultivation.

Another development which holds considerable promise is the culture of a number of nut and fruit crops on soils too rocky for mechanized sugar production. Experiments with the macadamia nut, avocado, lichee, and longan have shown that these can be grown on Hawaii's great acreages of rocky lava lands, much of which is wholly undeveloped. Government agencies are expanding their experimental work in these fields.

Forestry also offers possibilities. Remaining forests on Hawaii have been preserved mainly because they conserve water for agriculture and domestic use. In modern times little timber has been harvested because operations have been uneconomical, due to the poor quality of the remaining trees, or because stands of desirable timber are scattered. Although the replanting of native trees has been unsuccessful, there is ample evidence that certain trees of exotic species prized for their wood will produce a commercial crop on lands formerly occupied by native growths. Also, in the high elevation lands, several of the finest commercial trees of continental United States are showing exceptional vigor. Development of forestry seems emphatically worth pursuing, particularly as it would relieve pressure upon lumber sources in the United States.

In the postwar world it is expected that Americans will become world travelers to a greater extent than before the war, due partly to improved transportation, due partly to a higher level of national income, and due also to the fact that as a Nation our financial, industrial, and political interests are expanding. The Territory of Hawaii has a resource in its climate and scenic beauty which has provided recreational values for those who could afford to travel there for many years. Nearly any climate found in any other part of the world may be experienced in Hawaii, and the aspect of the land may vary from the lush green and brilliant coloring of the Tropics to the warm hues of the desert—but it is everywhere spectacularly beautiful.

Much remains to be done in making this resource available through cheapening transportation and installing recreational facilities from the beaches to the mountains. Moreover, there are many historical sites, and places associated with the romance and legends of the South Seas, the preservation and development of which deserve attention.

Fishery resources also have great commercial potentialities. The islands of the Hawaiian archipelago arose as volcanic cones from a great ocean depth. Due to their formation there is a minimum of coastal shoal water surrounding each island. This accounts for the Territory's relatively small inshore fishing, which reached a maximum many years ago.

However, the deep sea fisheries have hardly been touched. The pelagic type of fish, particularly tunas, which roam the deep seas and are not dependent upon shoal waters for food, are found in vast numbers in Hawaiian waters. They offer a food resource which can be developed into a major industry to the benefit of the people of Hawaii and of the United States.

The present technique for catching tuna in Hawaii is dependent upon the use of live bait, which is seined out of estuaries and inshore waters. The paucity of this bait supply has always limited the size of tuna fishing operations, and will continue to do so until fishing methods, not dependent upon this limiting factor, are developed. Deep sea operations are expensive, and the experimenting with different types of fishing gear is far more costly than private enterprise of limited capital can undertake. Assistance is required to devise new methods of harvesting the products of deep sea fisheries. Success in this field would do much to strengthen the economy of Hawaii and to extend the development of United States fisheries into the entire central and western Pacific.

Virgin Islands

The value of the Virgin Islands to the United States lies in their strategic position athwart the approaches to the Panama Canal and at the easternmost extension of American sovereignty into the Atlantic and in their unrivaled beauty and charm as a great potential tourist and recreation center for the American people. The other salient fact regarding these islands is that their people are American citizens and therefore deserve every possible assistance which we can give in reaching a sound and stable economic and social level.

At the present time the islands are verging on depression. The cessation of military activities at the naval and marine bases on St. Thomas and at Benedict Field on St. Croix, the effect of a severe drought in 1946 on sugar production and other agricultural activities, the virtual collapse for the time being of the rum market, and the failure of shipping and tourist activities to reach prewar levels, have resulted in considerable unemployment and in a heavy strain on municipal revenues. This situation has been aggravated by the high prices at which supplies, food, and clothing must be purchased in the United States, the sole source of supply.

To meet this situation a program of vigorous action is being developed by Federal and local authorities and private groups. It calls for activation as rapidly as practicable of the public-works program authorized by the Congress in 1944, stimulation in every way possible of tourist and shipping activities, operation by the municipalities of St. Thomas and St. Croix of the airports and other facilities to be made available soon by the Navy and the Army, energetic efforts by the Virgin Islands Company to improve production of cane and to develop other employment opportunities, and stimulation of private enterprise in building hotels and tourist facilities and in the development of small industries.

Puerto Rico

Despite the continued existence of tremendous difficulties due to its crowded and growing population and its economic imbalance, it is gratifying to state that the general situation in Puerto Rico has been much better in the last few years than in previous periods. Large expenditures in the island for military purposes and by personnel of the armed forces, very substantial revenues accruing to the insular government from the war-inflated rum tax, and profitable prices for the fairly large sugar yields of the last several years have resulted in considerable improvement of economic and commercial conditions in the island. While there is and will continue to be unemployment, especially during the slack season in sugar production, the unemployment situation is not so acute as in the past. There has been a rapid increase in the employment of Puerto Rican workers in various manual trades and occupations by both mainland manufacturers operating in Puerto Rico and by Puerto Rican enterprises. The insular government's program of industrial development has reached the point where several rather large enterprises are now in production and others under construction. These, in turn, will provide materials and experience for a large number of smaller enterprises to be developed by private capital.

A moderately priced housing program, primarily for veterans, is now fully under way with Federal support and is expected to provide some 14,000 homes with considerable consequent stimulation to trades and businesses in the housing field. The insular government is studying ways of stimulating the development of community industries which would give employment supplementing agricultural and domestic activities. As a partial offset to the rapid increase of population, the insular government is also developing a program of training and placement for Puerto Ricans migrating to the United States.

In this connection, it may be pointed out that, free of immigration restrictions, Puerto Rico is the largest available reservoir of easily trainable skilled workers for the United States. Experience has shown that Puerto Ricans can be readily trained and make generally satisfactory workers in any of the trades requiring manual skill. While there is some difficulty in the matter of language, this can be readily overcome. Puerto Rican women also make good domestic workers for which there is a tremendous demand in the United States.

The immediate outlook for the traditional basic industries of Puerto Rico is not too bright. The sugar quota system at present limits sale Puerto Rican sugar on the mainland to 910,000 tons, thereby precluding expansion even if much additional land were available. Mechanized and improved production per acre which may be forced by world competition will further reduce the possibility of employment in the industry. The other principal agricultural industries—tobacco and coffee production—face increasing difficulties from international competition. Indeed, the coffee industry finds it impossible to produce even a sufficient quantity for consumption within Puerto Rico, in spite of the heavy protection given by an 18-cent per pound tax on imported coffee and by crop insurance and other benefits from the insular government. To meet these agricultural difficulties, both the insular and Federal Governments are carrying on extensive programs of experimentation and research with the objectives of increasing local production of essential food and feed products, particularly proteins, of providing better returns of agricultural employment and, in general, for improving the economic position of the island by increasing home production and decreasing purchases on the mainland.

It cannot be too strongly emphasized that, with its excellent climate, good communications, and its large population of high potential capacity, Puerto Rico is a tremendous asset to the American people. Its problems are due to its one-sided economy and to the fact that industrial, educational, and social development has been allowed to lag behind its rapid increase in population. To close that gap will require the greatest energies of both Federal and insular Governments. When it is closed, Puerto Rico may well become one of the most productive and prosperous areas under the American flag.

BENEFITS ARE TWOFOLD

Production and conservation cost a lot of money at the time. They pay it back with interest later. This fact, however, is not always recognized in the contemplation of Federal expenditures for the development and conservation of the Nation's natural resources. The peculiarities of Federal budgeting and bookkeeping tend to hide the direct and indirect return from large annual expenditures for resources programs.

The returns of resource development and conservation to the people of the United States which accrue from the appropriation by the Congress and the expenditure of funds by the Federal Government are twofold: (1) Preservation and protection of the capital assets of the Nation, (2) the creation of new taxable wealth and employment.

Without either the Nation's future would shrivel and die on the vine.

It is not a simple process to demonstrate the monetary value of governmental programs in the field of resources development and conservation. Far too often, the demonstration is a negative one. Yet there are innumerable examples which can dramatize in a positive sense the contribution made by such programs. Perhaps the most outstanding comprises the amazing growth which has taken place in the Pacific Northwest States as a direct result of the expenditure of Federal funds for the coordinated development of the Columbia River.

At the bottom of the depression in 1933 the Federal Government assumed extensive responsibilities for the development of this area. Grand Coulee and Bonneville Dams were planned as multiple-purpose projects. Associated with each was the production of large quantities of hydroelectric energy, flood control, and navigation benefits. In addition, Grand Coulee will be the source of water supply for a vast irrigation project, as yet uncompleted.

Bonneville Dam was completed by the Corps of Engineers late in 1939, after war already had begun the devastation of Europe, and firs power deliveries were made into the Portland, Oreg., area, shortl thereafter. Grand Coulee Dam, planned and constructed by the Bureau of Reclamation, began delivering power in 1940. The Northwes owes the tremendous industrial development which has taken plac there in recent years largely to these two projects.

Today the power resources at Bonneville Dam are fully develope with 10 generators in operation with a peaking capacity of 570,00 kilowatts. Grand Coulee Dam has 6 of its ultimate 18 generator operating. Others are being installed or are scheduled for installation The six in operation have a peaking capacity of 720,000 kilowatts Thus generators with a capacity of almost 1,300,000 kilowatts now fee into the Bonneville Power Administration transmission system of about 3,000 miles of high-tension line.

War brought the opportunity for tremendous industrial expansion in the Northwest, but if the power from developments initiated and constructed by the Department of the Interior had not been available, only a fraction of this development could have occurred for the region because of limited coal supplies and lack of other types of fuel. The presence of low-cost power at uniform rates throughout the area acted as an irresistable magnet to industry. Aluminum, magnesium, ferro-alloys, chemicals, and numerous other industries have sprung up as a result.

An over-all view of what has happened to employment will help to make the sitation clear. In 1940 employed workers in Washington and Oregon numbered 997,500, while 172,400, or 15 percent of the total labor force, were unemployed. At present there are about 1,320,000 employed and 125,000, or 8 percent unemployed. The total number of workers in the area rose 285,100, or 24 percent, and the number of unemployed dropped by 47,400.

Thus far, the Government's investment in power plant in this area has amounted to about $280,000,000. Yet it has been established that payments to the Treasury in taxes on new private investment based upon federally generated power derived from Columbia River energy has been greater than this. Twelve of the larger new plants served directly by the Bonneville Power Administration have a plant investment of some $160,000,000. The atomic works at Hanford, Wash., a Government built and supervised plant, but privately operated, represents an investment of almost $400,000,000. These industrial plants to date have paid $58,000,000 in Federal income and excess profits taxes. Utilities purchasing Bonneville Power Administration energy have distributed it and paid excess profits taxes.

Indirect contributions to the Treasury probably have been much larger. The Boeing Aircraft Co. of Seattle, for instance, paid $116,000,000 in income and excess profits taxes in the 6 years 1941–45. Without aluminum produced with Columbia River energy it would have been impossible for the company to accumulate earnings calling for such large taxes. In 1947 Columbia River power will account for about 40 percent of the country's entire aluminum output.

A concrete example of how development of the Columbia River Basin is bolstering the economic strength of the Nation emerges from the story of a large aluminum rolling mill in Spokane. At present, this plant is supplying 20,000,000 pounds of plate, sheet, coil, and circle monthly to about 600 fabricators throughout the country. These in turn are manufacturing some 2,000 products, and employing 350,000 workers in their plants. A billion dollar pay roll spread over the country has become dependent largely upon the products of one plant in the Pacific Northwest, which itself was made possible only by the delivery of low-cost Federal power.

It is obvious from this that the planned development of natural resources in the river basins of the West, in which the Department of the Interior is now taking the leading part, has been wealth creating, income producing for the Treasury, and a tremendous stimulant to private industry and enterprise. New jobs for hundreds of thousands of workers result. The strengthening of industry and increase of population are an added bulwark for national security.

The impetus given to the Northwest, however, has created additional problems. So fast has been the growth in the consumption of electrical energy, both in home and factory, that private and public utilities of the region fear a power shortage. In January 1947 chief executives of the Pacific Northwest interconnected power systems in Oregon and Washington met in Tacoma to study their power supply and determine future requirements.

The Pacific Northwest power pool has some 3,561,000 kilowatts of available capacity, which does not include a few smaller plants which bring the area total to about 3,700,000 kilowatts. As a result of this conference it was revealed that in addition to the 745,000 kilowatts to be installed in Grand Coulee Dam, new Federal generating capacity of 318,000 kilowatts will be needed urgently before November 1949, and that an additional 1,565,000 kilowatts would be required by November 1953. In other words, the generating capacity of the western division of the Pacific Northwest power pool must be doubled within 5 years, if the area is not to be penalized for its progress.

Even though the Federal power rate for large quantities of energy is extremely low, the Bonneville Power Administration reported for the fiscal year 1947 a surplus of $6,606,197 after deduction of all charges for operation, maintenance, depreciation, and interest, according to preliminary statements. This compared with a net return for fiscal year 1946 of $4,754,895, an increase of 39 percent. Total power revenues for the year were $21,890,929 compared with $19,884,285 for the previous 12 months.

The year's power sales brought total revenues to the Bonneville Power Administration since its first sale of power in 1939 to $105,352,456, and total accumulated net surplus from power operations after all charges and interest to $22,933,144.

The demonstration which is occurring in the Pacific Northwest, although not the only one which could be selected, does portend the shape of things to come in the West. The evident continuation of population growth on the Pacific Coast States at rates which exceed those for other parts of the Nation can only be matched with necessary opportunity if the Federal Government contributes a major share to the development of basic resource tools, such as water, land, and power. The expenditures involved can only be viewed as capital additions to the national wealth, on a reimbursable basis for their major portion, and on a loan basis where the indirect accrued benefits will far exceed the loan made.

MANAGEMENT IS ESSENTIAL

In the discharge of its production and conservation responsibilities, the Department faces a legion of subjects, has more than a continent to cover, and enjoys a wide horizon of opportunities. Many of its responsibilities have grown by accretion; many of them have been by transfer; most of them arise from the needs of a modern expanding economy with consequent enlargement in the scope and area of Government activity. Obviously the complexity of administration and management requires a zealous awareness of and a willingness to accept and initiate improvements in procedure and operations.

In spite of complexities attendant on maintaining an organization in motion for the handling of current programs and still provide a degree of necessary innovation in procedures, the Department has made a great deal of progress during the past year in the establishment of improved techniques for the conception and execution of its programs. Without question, the most significant of these advances has been the increasing regionalization and greater degree of coordination both in Washington and in the field between the Department and other agencies of Government, and the public.

The regional idea is by no means a new one. Yet in spite of its long history, its fundamental objectives are not always clearly visualized. Actually the principle of regionalization as applied to Federal Government organization is based on the need for applying its functions and activities as closely as possible to the local needs and ambitions of the people of the regions which make up the Nation. The principle as far as much of the conservation and development function is concerned is epitomized for one region through the Tennessee Valley Authority.

On February 13, 1947, before the members of the Pacific Northwest Coordination Committee in Pocatello, Idaho, the Secretary of the Interior stated that the great need for increased efficiency of departmental services was made urgent by the magnitude of the Department's programs, and that this need therefore required the development and utilization of the best administrative mechanisms. He declared that the principle of "decentralized administration of centralized authority" had proven to be highly effective and highly democratic.

During the year, the Department instituted several devices for insuring full coordination of its activities in terms of Government-industry collaboration, in terms of interdepartmental coordination, and in terms of greater regionalization. For example, there was established a Federal Inter-agency Committee on Recreation and a Citizen's Advisory Committee on National Park Policies—both concerned with rendering greatest value in the administration of recreational resources under Federal stewardship. The National Petroleum Council was also established on a permanent basis as an advisory group to Government on all matters pertaining to this important resource. Several other industry advisory committees are in the process of formulation.

Inasmuch as many fields of activities in resources production and conservation are shared by more than one department of the Federal Government, especial consideration was given to interagency coordination both in Washington and in the field. An example in recreation has been cited but perhaps those of greater importance have dealt with interagency basin-wide committees, such as those for the Columbia River Basin and for the Missouri Valley. These committees have gone a long way toward effective correlation of the activities of numerous departments dealing with water, land, recreation, energy, fish, and wildlife, and correlated resources within river basins.

The establishment of the Pacific Northwest Coordination Committee within the Department in September 1946 marked a significant step in the direction of regionalization. The Committee, consisting of ranking resident officials of the Department's bureaus in the Pacific Northwest, has already made major contributions to the understanding and solution of the Department's problems in field organization and program coordination. In terms of resolving major conflicts, the Committee's attention to the apparently irreconcilable impact of Columbia River power and irrigation and navigation development in the future of salmon runs helped focus concerted attention on the Columbia fisheries problem and evolve a compromise plan to protect a large part of these runs and yet ease the critical power situation in the region.

Another major evidence of the Committee's effectiveness from a development point of view is the Department's western phosphate program.

The Nation's croplands need phosphorus as part of their essential plant food structure. Because phosphorus is a key element in the conservation of soil, it is now clearly recognized that unless substantial amounts of phosphorus chemicals are utilized as fertilizer the productivity of croplands will severely decline, with catastrophic results on the capabilities of the United States to feed its growing population and to assist foreign nations. However, the present national productive capacity for phosphate fertilizer production is probably inadequate to meet immediately future national needs and definitely not adequate to meet demands west of the Mississippi. The problem is not one of resources—as the United States is blessed with the world's largest known phosphate reserves—but it is one of establishment of more processing plants. In this respect, the Florida and Tennessee phosphate beds have been the focal point for the production of this much needed material. Obviously, the needs of the West—as far to the east as the Mississippi River—require long hauls of phosphate materials from existing production centers in the South, thus placing undue transportation-cost burdens upon the western consumer.

The existence of enormous phosphate rock and shale deposits in the States of Montana, Idaho, Wyoming, and Utah has been known for years, but production has been negligible. One of the principal contributory factors to this apparent neglect has been the lack of technology to provide a highly concentrated form of phosphate fertilizer which would permit substantial and economically feasible shipment to the wide market area which these deposits should serve.

In recent years, the advent of extremely low-cost electrical energy was instrumental in the removal of this technological bottleneck. The electric furnace offered a means whereby phosphate rock could be processed into elemental phosphorus at low cost, thus providing a base for the production of high concentration phosphate fertilizer.

The Department and its Pacific Northwest Coordination Committee analyzed this situation and concluded that the growing and critical western needs for phosphate fertilizer required overcoming several basic obstacles. These included a lack of detailed geologic and mining knowledge of the occurrence, quality, and quantity of western phosphate deposits; several questions as to the workability of the material—economically and technically; adequacy of corollary raw materials, water supplies, and sources of electric power. In addition, because a major portion of the known phosphate resources in the West exist in the public domain, there were grave questions as to the feasibility of large scale mining and processing operations due to the existing structure of mineral leasing laws.

As a consequence of these preliminary analyses, a comprehensive and rather ambitious program was charted, and almost immediately launched. It involved closely knit field programs of geologic and mining exploration, of laboratory tests upon phosphate rock and shale samples, of electric furnace tests, of byproduct recovery, of power-supply analysis, and of necessary examination of probable production costs under varying assumptions of markets. In this effort, the Bureau of Mines, the Geological Survey, the Bureau of Land Management, the Bureau of Reclamation, and the Bonneville Power Administration were called upon for specific program contributions. In addition, collaborative arrangements were instituted with the Tennessee Valley Authority, the Department of Agriculture, and the land-grant colleges. Over all were constant programs of contact and cooperation with both industry and farm interests so as to give every element of the Department's program closest relation to the needs of ultimate producers and consumers.

Considerable interest has been evinced by industry and agriculture. One plant unit for the production of phosphorous and phosphate material is under active engineering and financial consideration by industry. Progress has been made in field exploration; important results have been obtained in the laboratory work directed at the recovery of vanadium from the phosphate shales; revisions have been drafted and in some instances accepted in the application of mineral leasing laws; the limitations of power supply are fully recognized and plans for remedy are under active consideration. It is probable that plant operation by private industry may start within the next 2 years.

The example set by the Department's phosphate program impels the conclusion that a regional approach does serve to expedite progress in resources development and conservation. The fact that the Nation is made up of its regional parts is far too frequently ignored. The fact that each region may have potentials for a large degree of economic self-sufficiency—through the regional establishment of small industrial plants geared to regional requirements—has been too frequently relegated to minor consideration by both Government and industry. If there is to be an increasing measure of competition—basic to the maintenance of a healthy democratic system—and an increasing measure of industrial decentralization, the regional potentials must be exploited to the limit. Toward this end, the gap between Government programs and the acceptance of their results by local interest must be bridged. Regionalization can provide an effective mechanism for the harmonious correlation of plans, programs, and ultimate capital investment in the proper utilization of the Nation's resources on a scale yet unrealized. In this field, the Department proposes to continue its effort and work constantly for the best use of national, regional, and local governmental, industrial, and agricultural facilities, services, and resources.

PART II

Annual Reports of the Bureaus and Offices of the Department of the Interior

The Bureau of Reclamation

MICHAEL W. STRAUS, COMMISSIONER

DESIGN AND CONSTRUCTION

THE Bureau of Reclamation's design and construction program during the fiscal year 1947 continued at a high rate of accomplishment, in spite of severe obstacles which developed during the year. The first and worst of these obstacles came on August 2 when, in view of what seemed a real danger of adding to inflationary pressures which would have retarded reconversion, and for the purpose of holding back capital outlay, the President issued orders suspending awards of contracts for new construction projects. This order was rescinded on October 25, but the moratorium which had been placed upon construction prevented new work from being started in many areas until after the winter season. Later in the spring of 1947, when it became evident that the Congress in carrying out its policies of economy was going to effect considerable reductions in the amounts requested for construction during 1948, it became necessary to withhold advertisements for bids on a number of projects throughout the Bureau.

The fiscal year 1948 appropriation as set forth in the Senate bill may be insufficient to maintain work throughout the coming year under contracts in force on a few of the larger projects. Contractors' earnings will probably exhaust the indicated funds, including carry-overs, and bring work to a halt during the year on the Central Valley project, California; the Columbia Basin project, Washington; the Colorado-Big Thompson project, Colorado; the Davis Dam project, Arizona-Nevada; and the Anderson Ranch Dam project, Idaho.

Contract Awards

Starting 1947 with 203 million dollars available for construction, the Bureau was in the process of awarding construction contracts at the rate of one every working day. This rate continued until the limitation order of August 2, after which very few construction contracts were awarded until October 25. From that time until the end of the fiscal year, awards of contracts proceeded at a much lower rate. Even so, by the end of the fiscal year the Bureau of Reclamation had awarded contracts totaling 125 million dollars. Major contracts for construction, including dams, power plants, canals, pumping plants, distribution systems, and transmission lines, and major contracts for construction supplies, materials and equipment accounted for 92 million dollars of the total. Principal construction supplies and materials included were concrete aggregates, cement, reinforcement steel, and power line conductor and hardware. Important equipment items included were the hydroelectric-generating units R1, 2, and 3 for the right power house at Grand Coulee Dam, six motors for the Coulee Dam pumping plant on the Columbia Basin project, and five turbines for Davis Dam.

Dam Construction

Construction was started on 11 new dams. These are as follows: Cascade Dam, Boise project, Idaho; Potholes Dam, Columbia Basin, Wash.; Long Lake Dam, Columbia Basin, Wash.; Jackson Gulch Dam, Mancos project, Colorado; Granby Dam, Colorado-Big Thompson project, Colorado; Horsetooth Soldier Canyon, Dixie Canyon, and Spring Canyon Dams forming Horsetooth Reservoir, Colorado-Big Thompson project, Colorado; Missouri Basin project—Angostura Dam, Angostura unit, and Enders Dam, Frenchman-Cambridge unit.

At the end of the fiscal year construction was in progress on authorized projects on 15 dams, 10 power plants, 20 pumping plants, and 304 miles of main canals. During the year the Martinez Dam on the Contra Costa Canal system of the Central Valley project was completed. The completed portion of the Colorado-Big Thompson irrigation system was placed in emergency operation on June 23, 1947, when Colorado River water was diverted through the Alva B. Adams Continental Divide Tunnel to provide irrigation water needed to rescue a highly cultivated and important part of the agricultural area of 615,000 acres in northeastern Colorado from acute water shortages.

Shortages

Shortages in the available supply of construction materials, such as reinforcement steel, insulators and electrical conductor, continued to hamper construction operations throughout 1947. In an effort to alleviate this critical shortage, the Bureau tentatively followed the procedure of permitting the contractors to furnish these materials as part of the construction contracts. Cement was also included in the materials to be furnished by the contractors. This procedure has been found to be not altogether satisfactory, and it may become desirable to resume the former policy whereby the Government provides all construction supplies to be incorporated into the finished work.

Items of electrical equipment, such as transformers of the larger capacities, and insulators, have become unobtainable within the usual periods of delivery for this equipment, and manufacturers are requiring from 2 to 5 years for the manufacture and delivery in some contracts. For this reason it has been necessary to award contracts for this type of electrical equipment at the very earliest date possible in order that the equipment will be ready for installation in accordance with the construction schedule.

Rising Costs

Costs of both construction and materials, which increased sharply after VJ-day, continued to rise during 1947, though at a somewhat milder rate. The following comparison of construction cost indices is indicative of the increases which have occurred during this period:

	Jan. 1, 1946	Jan. 1, 1947
1940=1.00		
Dams:		
Concrete dams	1.60	1.75
Earth dams	1.70	1.95
Power plants and pumping plants:		
Building	1.60	1.85
Equipment	1.30	1.50
Penstocks or discharge pipes	1.40	1.80
Transmission systems:		
Wood pole lines	1.40	2.00
Substations	1.10	1.50
Permanent camps:		
Buildings	1.40	1.70
Utilities	1.60	1.80
Waterways:		
Canals, laterals and drains	1.70	1.95
Tunnels, free flow, concrete lined	1.50	1.85

NOTE.—The above cost indices for construction work are based on the combined costs of material and labor furnished by the contractor and material and labor furnished by the Government.

Research

Extensive research activities were carried on in the Denver laboratories on the investigation and development of improved construction material and designs. This work was directed toward such objectives as the improvement of better types of cement mixtures for concrete work; determination of soil characteristics in connection with the design of earth dams and embankments; geologic investigations for suitable materials for concrete aggregates and riprap and foundation materials; chemical analyses of waters, oils, paints, etc.; and hydrologic studies of models in connection with the design of irrigation structures.

Research on materials and structural designs will be greatly enhanced by the installation of the 5-million-pound vertical, hydraulic, universal-type testing machine for which contract was awarded during March of this year. This is one of the largest laboratory machines of this type and will enable the Bureau to carry out many investigations which were not possible heretofore.

During the previous year, studies were started on methods and materials to be used in the development of low-cost durable canal linings which would be applicable to small laterals and farm ditches. This work has been continued, and during 1947 the first practical field experiments with mechanized equipment were carried out on the W. C. Austin project in Oklahoma and on the Pasco division of the Columbia Basin project in Washington. Both cement and bituminous materials were used in these pilot tests. The tests indicated that economies in construction could be effected by these methods. Other tests embodying the placement of precast materials in canal lining were carried out on the Roza division of the Yakima project in Washington.

The laboratory has also conducted extensive investigations for outside agencies and other governmental departments. These investigations include studies and research on prepacked concrete for the Barker Dam for the Public Service Co. of Colorado; light-weight concrete, for the National Housing Agency; the Ross Dam, for the city of Seattle; aggregate and silt analyses and model tests in connection with designs for the Almo and Cherry Creek Dams, being built by the Corps of Engineers, United States Army; concrete testing, for the veterans hospital, Colorado; testing of paint materials, for the Bureau of Federal Supply; and laboratory and model studies in connection with designs for the Yangtze River Basin project, China.

A number of the Bureau's outstanding technical authorities participated as representatives of the Bureau and the United States in international technical conferences.

Denver Federal Center

During the latter part of 1946, the Bureau of Reclamation was occupying office space in 12 separate Federal establishments and privately owned buildings in the Denver area, totaling approximately 230,000 square feet of office space and approximately 120,000 square feet of laboratory and warehouse space. The increased numbers of personnel necessary to accomplish the construction program established by the Congress, and for which funds were appropriated, made it essential that additional space be located immediately. Utilization of the surplus Denver ordnance plant permitted the Bureau to consolidate all of its activities in a single center, and to gain this necessary space immediately and without the construction of new and expensive Federal buildings. The use of the Denver ordnance plant as a Federal center is also to the interest of the Government in that it saves a surplus war property for the use of the Government in any possible future emergency.

OPERATION AND MAINTENANCE

Public land openings.—Seven public notices opening lands to entry were issued during the year. World War II veterans were given a 90-day preference period in which to apply for homestead units. Nearly 5,400 applications—96 percent from veterans—were received by the local examing boards for the 245 farm units totaling approximately 20,500 irrigable acres available for homestead entry on the seven projects. Some 6,500 inquiries concerning settlement opportunities were received in the Commissioner's office and substantially more in the field offices. Because of the very large number of applicants, nearly 22 per available farm unit, awards were made by means of "drawings" among those applicants on each project who met the requirements established by the various public notices. Most of the veteran homesteaders at the close of the year were establishing residence on their entries and beginning to farm at least a portion of their irrigable land.

The speed with which these openings were conducted was due largely to the increased authority and responsibility placed on the local examining boards.

Wherever available funds make it practicable, the Bureau is accelerating its construction program in order to make as many additional farm units as possible available for veteran settlement during the coming year. Some 71,000 acres of public land, comprising nearly 800 farm units, are scheduled for opening to entry in fiscal year 1948. Land openings in 1947, and those scheduled for 1948 are:

Project	1947		1948	
	Irrigated farms		Irrigated farms	
	Acreage	Units	Acreage	Units
Klamath, Tule Lake division	7, 527	86	10, 000	110
Shoshone, Heart Mountain division	7, 720	83	30, 115	313
Yakima, Roza division	1, 722	28	1, 957	35
Minidoka, Gooding division	3, 226	43	4, 600	60
Owyhee	150	3		
Vale	43	1		
Sun River	74	1		
Boise, Payette division			7, 000	115
Riverton			15, 850	158
Yuma			1, 439	28
Gila, Yuma Mesa division			4, 935	54
Total	20, 462	245	75, 896	873

Settler Assistance

In order to provide the full opportunity for veteran settlers to develop their farm units as rapidly and effectively as possible, the Bureau has taken the leadership in providing settler assistance in cooperation with other Federal and State agencies. Agencies of the Department of Agriculture, the Veterans' Administration, and State agricultural experiment stations, extension services, and vocational departments are all cooperating in a planned program to provide settlers with the advice and services they may require in the systematic development of their farm units. Advice and assistance are provided in the clearing and leveling of the irrigable lands; lay-out and roughing-in of the farm distribution and drainage system; weed control; cropping systems and cultural practices; livestock operations; farm management; credit; and in both classroom and on-farm training. Each of the agencies provides the types of assistance for which they are best equipped with personnel and facilities.

Outstanding among the types of assistance provided on new projects, as well as those established for a number of years, is that on the control of both land weeds and water weeds. The Bureau of Reclamation and the Bureau of Plant Industry of the Department of Agriculture are cooperatively conducting weed control research work.

Land Use Integration

As additional reclamation projects are built and fully developed the relationship between the irrigated farm lands and the surrounding dry-land areas becomes more apparent. This fact has been particularly recognized during the past year and increased emphasis is being given to this relationship in the development of new projects. This is especially applicable to the type of development being carried out in the Missouri Basin. Analysis of the movement of feeds and livestock between the irrigated farms and the ranches and dry farms shows an interdependence among the several types that adds materially to their security and stability during dry periods and to their economic well-being during periods of normal rainfall. The irrigated farms provide a convenient and advantageous market for feeder livestock produced in the surrounding territory and in addition provide a ready source of feed to supplement the range and dry-land feed supply.

Crop Production

For the first time in the 45 years of history of the Bureau of Reclamation, the value of crops produced on lands served by project systems in 1946 exceeded half a billion dollars, reaching a total of

Settlement and economic data, calendar year 1946

REGULAR PROJECTS

State	Project	Irrigated farms		Towns on or tributary to the project		Number of schools	Number of churches	Banks			Special Warren Act contractors	
		Number	Population	Number	Population			Number	Deposits	Number of depositors	Irrigated farms [1]	Population
Arizona	Salt River	14,000	42,000	9	202,000	98	355	9	$209,559,615	80,000	1,240	7,061
	Gila (Yuma Mesa division)	7	35	0	0	0	0	0	0	0	2	5
Arizona-California	Yuma	1,973	1,938	5	23,040	14	35	2	(2)	(2)	------	------
California	Orland	679	2,328	1	2,000	5	12	1	4,898,000	4,400	------	------
Colorado	Grand Valley [3]	511	1,545	6	25,700	17	40	4	21,091,000	12,200	807	1,830
	Uncompahgre	1,565	4,895	3	8,910	28	35	4	13,610,949	7,320	------	------
Idaho	Boise	4,242	16,300	16	68,035	118	142	3	265,271,257	(2)	4,764	19,966
	Minidoka	3,424	11,280	10	15,752	34	56	6	105,628,511	(2)	9,518	35,432
Montana	Bitter Root	309	1,163	5	5,700	14	13	4	7,483,198	6,200	------	------
	Frenchtown	40	137	1	100	1	1	0	0	0	------	------
	Huntley	651	1,372	5	761	5	6	1	562,231	503	------	------
	Milk River	766	2,669	15	15,423	29	39	7	20,283,869	11,998	------	------
	Sun River	1,017	2,597	5	965	10	15	1	900,000	815	------	------
Montana-North Dakota	Lower Yellowstone	641	2,228	7	4,620	17	23	3	7,719,014	4,600	------	------
Nebraska-Wyoming	North Platte	2,752	7,564	16	34,077	72	73	12	41,436,194	37,950	1,595	8,208
Nevada	Newlands	793	2,555	4	3,500	16	12	1	4,475,000	3,200	------	------
New Mexico	Carlsbad	438	1,417	4	22,700	14	20	2	11,101,000	8,300	------	------
	Tucumcari	53	180	1	9,500	6	14	1	6,582,682	4,532	------	------
New Mexico-Texas	Rio Grande	6,285	31,798	31	159,432	84	185	6	142,927,246	70,613	139	1,221
Oklahoma	Altus	13	8	3	12,950	13	27	3	9,771,067	7,150	------	------
Oregon	Deschutes (north unit)	142	338	6	16,150	23	32	4	(2)	(2)	------	------
	Umatilla (east and west divisions)	403	1,393	5	3,207	8	17	1	3,137,722	2,700	38	76
	Vale	497	1,622	4	1,900	8	14	1	2,929,047	2,000	------	------
Oregon-California	Klamath	996	3,231	5	33,474	30	36	4	(2)	(2)	577	1,200
Oregon-Idaho	Owyhee	1,679	7,520	8	21,250	28	25	10	(2)	(2)	235	700
South Dakota	Belle Fourche	531	1,540	5	4,260	25	22	3	10,319,744	6,590	------	------
Utah	Strawberry Valley	1,935	5,800	8	32,854	22	21	4	11,824,261	(2)	------	------
Washington	Okanogan	399	1,169	3	5,350	8	8	2	8,362,333	3,320	------	------
	Yakima	5,721	21,648	24	60,654	50	88	9	30,486,795	20,814	4,683	18,450
Wyoming	Kendrick	13	41	4	27,800	16	23	2	28,627,023	11,200	------	------
	Riverton	471	1,352	3	3,639	4	11	1	3,751,885	1,600	2	10
	Shoshone	1,008	2,296	5	3,308	3	15	1	3,525,226	2,400	------	------
	Subtotal	53,954	181,959	227	829,011	820	1,415	112	976,264,869	310,405	23,600	94,159

Settlement and economic data, calendar year 1946—Continued

SUPPLEMENTAL STORAGE PROJECTS

State	Project	Irrigated farms		Towns on or tributary to the project		Number of schools	Number of churches	Banks			Special Warren Act contractors	
		Number	Population	Number	Population			Number	Deposits	Number of depositors	Irrigated farms [1]	Population
California	All-American Canal—Imperial Valley	4, 500	28, 000	8	32, 500	63	26	7	(2)	(2)		
Colorado	Fruitgrowers Dam	88	352	1	300	2	2	0	0	0		
	Pine River	320	850	5	1, 105	20	12	3	$10, 741, 762	500		
Idaho	Minidoka (Fremont-Madison irrigation district).	1, 500	5, 476	14	11, 398	23	20	4	8, 236, 452	10, 176		
Nevada	Humboldt	113	263	1	1, 200	2	6	1	(2)	(2)		
	Truckee River Storage [2]											
Oregon	Baker	40	142	1	3	2	0	0	0	0		
	Burnt River	118	900	8	3, 300	8	4	1	589, 727	(2)		
	Deschutes (central Oregon irrigation district).	750	2, 190		(4)	(4)	(4)	(4)	(4)			
	Stanfield	160	492	1	575	2	2	0	0	0		
	Westland	96	360	1	10	1	1	0	0	0		
Utah	Hyrum	598	2, 895	3	3, 900	5	6	0	(2)	(2)		
	Moon Lake	650	3. 400	1	1. 260	9	17	1	2, 295, 000	3, 400		
	Ogden River	970	4, 900	8	90, 000	35	57	3	105, 000, 000	35, 000		
	Provo River (Deer Creek division)			7	62, 500	25	50	7	22, 438, 560	24, 668		
	Sanpete	223	670	2	2, 915	5	4	1	2, 000, 000	(2)		
	Subtotal	10, 126	50, 890	61	210, 966	202	207	28	151, 301, 501	73, 744		

WATER CONSERVATION AND UTILIZATION PROJECTS

State	Project	Irrigated farms Number	Irrigated farms Population	Towns Number	Towns Population	Number of schools	Number of churches	Banks Number	Deposits	Number of depositors	Irrigated farms [1]	Population
Idaho	Rathdrum Prairie	85	300	1	800	2	2	0	0	0		
Montana	Buffalo Rapids	210	426	2	2, 300	10	23	2	$7, 861, 336	5, 100		
	Intake	4	10	0	0	1	1	0	0	0		
Nebraska	Mirage Flats	38	122	1	919	4	2	0	0	0		
North Dakota	Buford-Trenton	56	212	5	9, 976	5	4	4	(2)	(2)		
Utah	Newton	134	657	1	549	1	1	0	0	0		
	Scofield	450	2, 700	4	12, 900	12	13	3	13, 791, 928	13, 110		
	Subtotal	977	4. 427	14	27, 444	35	46	9	21, 653, 264	18, 210		
	Grand total	65, 057	237, 276	302	1, 067, 421	1, 057	1, 668	149	1, 149, 219, 634	402, 359	23. 600	94, 159

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[1] Farms furnished partial or whole water supply under Warren Act or other special contracts.

[2] Data not reported.

[3] Gravity division only; does not include Orchard Mesa irrigation district.

[4] Same as shown.

Cumulative crop values, calendar years 1906–1946

Year	Federal irrigation projects [1]				Warren Act lands and special contractors				Entire area			
	Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value	
			For year	Cumulative total			For year	Cumulative total			For year	Cumulative total
1906	22,300	[2] 20,100	$244,900						22,300	[2] 20,100	$244,900	
1907	187,628	[2] 169,000	4,760,460	$5,005,360					187,628	[2] 169,000	4,760,460	$5,005,360
1908	289,549	[2] 260,500	7,635,888	12,641,248					289,549	[2] 260,500	7,635,888	12,641,248
1909	410,628	[2] 369,500	11,920,663	24,561,911					410,628	[2] 369,500	11,920,663	24,561,911
1910	417,423	413,000	12,944,639	37,506,550					471 423	413,000	12,944,639	37,506,550
1911	562,311	470,100	13,086,441	50,592,991					562,311	470,100	13,086,441	50,592,991
1912	614,477	540,000	16,007,134	66,600,125					614,477	540,000	16,007,134	66,600,125
1913	694,142	637,227	15,676,409	82,276,534					694,142	637,227	15,676,409	82,276,534
1914	761,271	703,424	16,475,517	98,752,051					761,271	703,424	16,475,517	98,752,051
1915	810,649	760,035	18,164,452	116,916,503					810,649	760,035	18,164,452	116,916,503
1916	922,821	858,291	32,815,972	149,732,475					922,821	858,291	32,815,972	149,732,475
1917	1,026,663	966,784	56,462,313	206,194,788					1,026,663	966,784	56,462,313	206,194,788
1918	1,119,566	1,051,193	66,821,396	273,016,184	[2] 501,100	[2] 481,600	$35,000,000		[2] 1,620,666	1,532,793	101,821,396	308,016,184
1919	1,187,255	1,113,469	88,974,137	361,990,321	916,313	880,613	64,368,468	$99,368,468	2,103,568	1,994,082	153,342,605	461,358,789
1920	1,223,480	1,153,820	66,171,650	428,161,971	981,940	950,890	47,836,750	147,205,218	2,205,420	2,104,710	114,008,400	575,367,189
1921	1,227,500	1,157,900	49,620,300	477,782,271	1,001,250	969,550	45,288,630	192,493,848	2,228,750	2,127,450	94,908,930	670,276,119
1922	1,202,130	1,169,100	50,360,850	528,143,121	983,290	951,270	33,240,840	225,734,688	2,185,420	2,120,370	83,601,690	753,877,809
1923	1,213,700	1,179,870	65,046,300	593,189,421	1,051,380	993,040	37,557,860	263,292,548	2,265,080	2,172,910	102,604,160	856,481,969
1924	1,290,890	1,216,610	66,488,560	659,677,981	930,670	889,460	43,237,470	306,530,018	2,221,560	2,106,070	109,726,030	966,207,999
1925	1,320,300	1,242,750	77,608,880	737,286,861	1,019,170	951,250	53,655,850	360,185,868	2,339,470	2,194,000	131,264,730	1,097,472,729
1926	1,411,020	1,328,810	60,369,620	797,656,481	1,097,190	949,590	49,750,040	409,935,908	2,508,210	2,278,400	110,119,660	1,207,592,389
1927	1,378,990	1,326,810	70,985,450	868,641,931	1,148,115	1,072,486	61,160,010	471,095,918	2,527,105	2,399,296	132,145,460	1,339,737,849
1928	1,442,080	1,385,560	80,238,800	948,880,731	1,235,020	1,192,030	62,495,320	533,591,238	2,677,100	2,577,590	142,734,120	1,482,471,969
1929	1,483,900	1,420,070	87,559,670	1,036,440,401	1,234,230	1,192,990	72,720,490	606,311,728	2,718,130	2,613,060	160,280,160	1,642,752,129
1930	1,504,810	1,467,097	64,418,940	1,100,859,341	1,286,046	1,254,493	54,654,550	660,966,278	2,790,856	2,721,590	119,073,490	1,761,825,619
1931	1,522,718	1,462,565	40,121,089	1,140,980,430	1,293,889	1,251,830	33,406,340	694,372,618	2,816,607	2,714,395	73,527,429	1,835,353,048
1932	1,555,144	1,506,320	31,165,752	1,172,146,182	1,214,461	1,196,400	18,627,219	712,999,837	2,769,605	2,702,720	49,792,971	1,885,146,019
1933	1,589,770	1,529,903	48,138,576	1,220,284,758	1,239,017	1,199,113	35,425,870	748,425,707	2,828,787	2,729,016	83,564,446	1,968,710,465
1934	1,552,124	1,464,405	59,628,327	1,279,913,085	1,285,081	1,229,594	40,160,676	788,586,383	2,837,205	2,693,999	99,789,003	2,068,499,468
1935	1,640,936	1,604,166	63,601,663	1,343,514,748	1,294,680	1,256,970	43,179,631	831,766,014	2,935,616	2,861,136	106,781,294	2,175,280,762
1936	1,702,192	1,629,174	78,902,818	1,422,417,566	1,335,995	1,272,745	57,599,662	889,365,676	3,038,187	2,901,919	136,502,480	2,311,783,242
1937	1,725,463	1,700,969	72,893,649	1,495,311,215	1,389,338	1,333,800	45,764,623	935,130,299	3,114,801	3,034,769	118,658,272	2,430,441,514
1938	1,777,584	1,764,363	67,859,804	1,563,171,019	1,329,115	1,276,332	45,603,656	980,733,955	3,106,699	3,040,695	113,463,460	2,543,904,974
1939	1,922,868	1,903,269	73,769,654	1,636,940,673	1,218,108	1,174,803	40,313,140	1,021,047,095	3,140,976	3,078,072	114,082,794	2,657,987,768
1940	2,152,808	2,138,927	80,098,196	1,717,038,869	1,238,262	1,177,103	37,690,481	1,058,737,576	3,391,070	3,316,030	117,788,677	2,775,776,445
1941	2,199,179	2,178,288	110,399,806	1,827,438,675	1,140,204	1,202,172	49,486,191	1,108,223,767	3,339,383	3,380,460	159,885,997	2,935,662,442
1942	2,277,955	2,259,653	155,619,716	1,983,058,391	1,602,907	1,562,046	116,428,800	1,224,652,567	3,880,862	3,821,699	272,048,516	3,207,710,958
1943	2,422,288	2,398,922	218,064,208	2,201,122,599	1,633,041	1,615,424	170,606,761	1,395,259,328	4,055,329	4,014,346	388,670,969	3,596,381,927
1944	2,468,842	2,475,280	224,683,280	2,425,805,879	1,694,861	1,664,069	186,543,084	1,581,802,412	4,163,703	4,139,349	411,226,364	4,007,608,291
1945	2,416,961	2,464,672	232,545,321	2,658,351,200	1,745,627	1,731,060	202,639,074	1,784,441,486	4,162,588	4,195,732	435,184,395	4,442,792,686
1946	2,513,687	2,567,050	279,711,300	2,938,062,500	1,808,282	1,829,531	250,912,645	2,035,354,131	4,321,969	4,396,581	530,623,945	4,973,416,631

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[1] Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by United States.

[2] Estimated.

Projects in operation—irrigation and crop value data for the calendar year 1946

State, project, and subdivisions	Projects entirely constructed by the bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
			Land subject to construction charges			Temporarily suspended lands [2]											
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre						Total	Per acre				Total	Per acre
ARIZONA																	
	Acres	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Salt River	243,125	215,378	228,500	$41,043,385	$179.62								92,012	81,178	81,178	$8,134,521	$100.21
Gila	5,715	3,232	3,232	224,661	69.51								370	330	330	53,313	161.55
ARIZONA-CALIFORNIA																	
Yuma:																	
Valley division (Arizona)	50,390	45,887	45,700	10,379,312	227.12	187	$19,105										
Reservation division (California)	7,743	2,944	2,944	214,169	72.75	0	0										
Bard division (California)	6,878	5,278	5,276	407,747	77.28	2	144										
Yuma auxiliary (Mesa) (Arizona)	3,965	2,112	2,112	628,624	297.64	0	0										
Total—Yuma project	68,976	56,221	56,032	11,629,852	207.56	189	19,249										
CALIFORNIA																	
All-American Canal: Imperial irrigation district													523,000	400,000	415,000	73,761,900	177.74
Central Valley													160,233	138,553	138,553	34,023,664	245.56
Orland	20,091	16,735	16,735	1,801,132	107.63												
COLORADO																	
Fruitgrowers Dam								2,662	1,774	1,784	$175,358	$98.29					
Grand Valley:																	
Gravity division	30,444	19,336	19,336	1,602,058	82.85												
Orchard Mesa irrigation district [3]	10,027	8,411	8,611	1,519,177	176.42												
Total—Grand Valley project	40,471	27,747	27,947	3,121,235	111.68								8,000	4,337	7,433	1,606,242	216.10
Pine River																	

IDAHO																	
Boise:																	
Big Bend irrigation district	1,717	1,491	1,416	85,428	60.33	75	1,875										
Black Canyon irrigation district (Notus)	6,883	6,138	6,138	768,212	125.16	0	0										
Black Canyon irrigation district (Payette)	27,760	20,267	20,340	1,228,298	60.39	0	0										
Boise-Kuna irrigation district	48,488	44,541	44,928	3,723,831	82,88	19	570										
Nampa-Meridian irrigation district	40,098	34,304	34,185	2,427,216	71.00	164	4,920										
New York irrigation district	17,826	14,726	15,001	695,944	46.39	0	0										
Settlers irrigation district	518																
Wilder irrigation district	56,618	49,937	48,482	5,683,838	117.24	1,455	84,735										
Total—Boise project	199,908	171,404	170,490	14,612,767	85.71	1,713	92,100						125,303	116,328	116,328	10,574,931	90.91
Minidoka:																	
Minidoka irrigation district	71,871	61,156	60,506	5,466,823	90.35	650	0										
Burley irrigation district	47,937	44,234	44,234	4,203,345	95.03	0	0										
American Falls reservoir district No. 2	93,353	76,815	76,815	4,458,096	58.04	0	0										
Fremont-Madison irrigation district								95,518	93,521	93,521	6,380,684	68.23					
Total—Minidoka project	213,161	182,205	181,555	14,128,264	77.82	650	0						711,059	672,799	672,799	66,576,177	98.95
Rathdrum Prairie [4]								3,109	1,446	[5] 1,531	22,343	31.74					
MONTANA																	
Bitter Root [3]	16,575	16,291	16,500	554,886	33.63												
Buffalo Rapids:																	
First division	14,826	14,254	14,254	782,730	54.91												
Second division	8,100	6,235	6,279	78,505	12.50												
Total—Buffalo Rapids project [4]	22,926	20,489	20,533	861,235	41.94												
Frenchton	5,127	2,780	3,496	152,819	43.71												
Huntley	32,508	24,791	17,199	1,171,225	68.10	8,063	266,157										
Intake [4]	711	422	422	16,208	38.41												

See footnotes at end of table.

Projects in operation—irrigation and crop value data for the calendar year 1946—Continued

State, project, and subdivisions	Projects entirely constructed by the bureau							Projects furnished supplemental storage water from works constructed by the bureau					Special and Warren Act contractors receiving water from bureau constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]											
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre						Total	Per acre				Total	Per acre
MONTANA—con.																	
Milk River:	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Malta division	56, 652	25, 565	16, 004	$791, 176	$49. 44	9, 699	$149, 086										
Glasgow division	21, 997	9, 375	9, 204	409, 663	44. 51	263	6, 575										
Chinook division	43, 484	28, 715	28, 834	1, 649, 259	57. 20	0	0										
Pump Lands	4, 419	4, 419	4, 419	385, 178	87. 16	0	0										
Total—Milk River project	126, 552	68, 074	58, 461	3, 235, 276	55. 34	9, 962	155, 661										
Sun River:																	
Fort Shaw division	13, 902	7, 642	8, 291	242, 862	29. 29	208	5, 893										
Greenfields division	83, 128	66, 501	72, 482	2, 271, 027	31. 33	0	0										
Total—Sun River project	97, 030	74, 143	80, 773	2, 513, 889	31. 12	208	5, 893										
MONTANA-NORTH DAKOTA																	
Lower Yellowstone:																	
District No. 1 (Montana)	37, 272	32, 413	31, 894	2, 100, 474	65. 86	519	29, 696										
District No. 2 (North Dakota)	19, 928	15, 674	15, 496	919, 386	59. 33	178	6, 718										
Total—Lower Yellowstone project	57, 200	48, 087	47, 390	3, 019, 860	63. 72	697	36, 414										
NEBRASKA																	
Mirage Flats [4]	12, 000	2, 922	2, 922	177, 267	60. 67												

NEBRASKA-WYOMING																	
North Platte:																	
Pathfinder irrigation district	112, 943	94, 246	77, 051	6, 313, 623	81. 94	17, 195	347, 005										
Gering and Fort Laramie irrigation district	54, 845	51, 982	50, 582	4, 297, 312	84. 96	1, 400	35, 012										
Goshen irrigation district (Wyoming)	52, 486	46, 046	42, 811	3, 432, 091	80. 17	3, 235	31, 140										
Northport irrigation district	16, 170	9, 796	8, 673	469, 201	54. 10	1, 123	19, 357										
Total—North Platte project	2 36, 444	202, 070	179, 11	714, 512, 227	81. 02	22, 953	432, 514						132, 365	118, 666	126, 682	$11, 460, 652	$90. 47
NEVADA																	
Humboldt								38, 889	21, 537	27, 370	$1, 647, 896	$60. 21					
Newlands	68, 402	58, 893	58, 437	2, 475, 814	42. 37	544	17, 464										
Truckee River storage								29, 376									
NEW MEXICO																	
Carlsbad	25, 055	19, 854	19, 854	1, 984, 380	99. 95												
Tucumcari	6, 631	2. 527	2, 527	216, 109	85. 52												
NEW MEXICO-TEXAS																	
Rio Grande:																	
Elephant Butte irrigation district (New Mexico)	88, 000	90, 099	85, 499	20, 255, 686	236. 91	4, 600	656, 888										
El Paso County water improvement district No. 1 (Texas)	67, 000	66, 477	63, 565	18, 020, 164	283. 49	3, 005	530, 733										
Total—Rio Grande project [6]	155, 000	156, 576	149, 064	38, 275, 850	256. 77	7, 605	1, 187, 621						18, 045	16, 230	16, 230	3, 766, 693	232. 08
NORTH DAKOTA																	
Buford-Trenton [4]	6, 709	6, 153	6, 476	198, 813	30. 70												
OKLAHOMA																	
Altus	451	451	451	58, 954	130. 72												

See footnotes at end of table.

Projects in operation—irrigation and crop value data for the calendar year 1946—Continued

State, project, and subdivisions	Projects entirely constructed by the bureau							Projects furnished supplemental storage water from works constructed by the bureau					Special and Warren Act contractors receiving water from bureau constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
OREGON	*Acres*	*Acres*	*Acres*			*Acres*		*Acres*	*Acres*	*Acres*			*Acres*	*Acres*	*Acres*		
Baker								7, 312	7, 312	7, 312	$226, 393	$30. 96					
Burnt River								15, 291	15, 291	15, 291	532, 815	34. 85					
Deschutes (Central Oregon irrigation district)								42, 382	39, 846	39, 846	4, 013, 843	100. 73					
Deschutes—north unit	15, 495	6, 989	8, 259	$229, 724	$27. 81												
Stanfield								6. 000	5, 069	5, 069	238, 204	45. 02					
Umatilla:																	
East division	10, 911	6, 835	6, 835	295, 678	43. 26												
West division	7, 620	4, 813	5, 101	212, 441	41. 65												
Total—Umatilla project	18, 531	11, 648	11, 936	508, 119	42. 57								1, 012	840	965	$67, 269	$69. 71
Vale	32, 000	31, 715	31, 715	2, 415, 094	76. 15												
Westland								8, 052	3, 933	3, 933	158, 167	40. 22					
OREGON-CALIFORNIA																	
Klamath:																	
Main division (Oregon)	40, 998	32, 310	31, 893	4, 594, 870	144. 07	929	$43, 810										
Tule Lake division (California)	25, 569	24, 223	24, 286	4, 577, 540	188. 48	65	4, 834										
Total—Klamath project	66, 567	56, 533	56, 179	9, 172, 410	163. 27	994	48, 644						82, 761	69, 982	69, 982	6, 469, 340	92. 44
OREGON-IDAHO																	
Owyhee:																	
Advancement irrigation district	701	598	598	37, 911	63. 40	0	0										
Bench irrigation district	2, 310	2, 195	2, 216	293, 498	132. 44	0	0										

Crystal irrigation district	1, 264	1, 073	1, 165	133, 233	114. 36	0	0									
Owyhee irrigation district	55, 629	48, 857	48, 952	4, 226, 858	86. 35	204	11, 876									
Payette-Oregon Slope irrigation district	4, 617	4, 166	4, 191	564, 928	134. 80	0	0									
Ontario-Nyssa irrigation district	5, 873	5, 393	5, 489	590, 107	107. 51	0	0									
Gem irrigation district (Idaho)	31, 022	28. 508	28, 104	2, 580, 951	91. 84	809	38, 214									
Slide irrigation district	1, 127	1, 064	1, 081	136, 423	126. 20	0	0									
Total—Owyhee project	102, 543	91, 854	91, 796	8, 563, 909	93. 29	1, 013	50, 090						13, 800	13, 130	13, 130	1, 443, 962	109. 97
SOUTH DAKOTA																
Belle Fourche	72, 431	38, 570	52, 739	2, 058, 531	39. 03											
UTAH																
Hyrum								6, 261	5, 605	5, 704	324, 198	56. 84					
Moon Lake								72, 608	55, 786	55, 786	895, 577	16. 05					
Newton [4]								2, 225	1, 948	1, 948	119, 223	61. 20					
Ogden River								20, 642	15, 606	15, 618	1, 426, 998	91. 37					
Provo River—Deer Creek division								46, 208	37, 272	37, 968	5, 127, 335	135. 04					
Sanpete:																
Ephraim division								6, 700	5, 951	6, 225	142, 933	22. 96					
Spring City division								6, 017	4, 367	4, 567	143, 060	31. 32					
Total—Sanpete project								12, 717	10, 318	10, 792	285, 993	26. 50					
Scofield [4]								15, 599	13, 884	15, 009	678, 150	45. 18					
Strawberry Valley:																
Highline division	18, 403	16, 076	16, 899	766, 322	45. 35											
Spanish Fork division	13, 743	12, 950	13, 242	894, 346	67. 54											
Springville-Mapleton division	9, 201	8, 061	8, 147	810, 617	99. 50											
Total—Strawberry Valley project	41, 347	37, 087	38, 288	2, 471, 285	64. 54								5, 068	4, 774	4, 882	335, 790	68. 78
Weber River (Salt Lake Basin)								91, 374	90, 042	90, 617	12, 959, 405	143. 01					
WASHINGTON																
Okanogan	5, 323	3, 966	3, 966	2, 806, 600	707. 67											

See footnotes at end of table.

Projects in operation—irrigation and crop value data for the calendar year 1946—Continued

State, project, and subdivisions	Projects entirely constructed by the bureau							Projects furnished supplemental storage water from works constructed by the bureau					Special and Warren Act contractors receiving water from bureau constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
WASHINGTON—continued																	
Yakima:	Acres	Acres	Acres			Acres		Acres	Acres	Acres			Acres	Acres	Acres		
Sunnyside division	103,579	82,745	84,479	$16,923,425	$200.33	566	$26,331										
Tieton division	27,355	24,470	24,513	18,326,004	747.60	0	0										
Kittitas division	69,552	54,186	54,403	2,916,719	53.61	97	776										
Rosa division	44,480	27,138	27,046	5,486,826	202.87	92	7,618										
Total—Yakima project	244,966	188,539	190,441	43,652,974	229.22	755	34,725						191,700	162,239	160,239	$32,403,866	$202.22
WYOMING																	
Kendrick	5,000	654	654	11,691	17.88												
Riverton	42,502	38,194	38,194	2,185,760	57.23								422	422	422	17,901	42.42
Shoshone:																	
Garland division	41,627	33,690	33,010	2,305,272	69.84	680	14,864										
Frannie division	20,041	12,229	11,450	422,962	36.94	779	21,298										
Willwood division	11,542	10,689	10,620	713,667	67.20	69	1,122										
Heart Mountain division	13,938																
Total—Shoshone project	87,148	56,608	55,082	3,441,901	62.49	1,528	37,284										
Total	2,486,793	2,004,772	1,990,620	236,643,558	118.88	58,583	2,448,817	550,768	452,716	461,647	$35,885,966	$77.74	2,071,070	1,808,282	1,829,531	250,912,645	137.15
Total—regular projects	2,486,793	2,004,772	1,990,647	236,643,558	118.88												
Total—storage projects	550,768	452,716	461,611	35,886,966	77.74												
Total—special and Warren Act projects	2,071,070	1,808,282	1,829,531	50,912,645	137.15												

Additional areas reported:																	
Temporarily suspended			58, 583	2, 448, 817	41. 80												
Leased areas		56, 199	56, 199	4, 731, 959	84. 20												
Total	5, 108, 631	4, 321, 969	4, 396, 581	530, 623, 945	120. 69												
Additional irrigable lands no crop details reported [7]	42, 200																
Grand total	5, 150, 831	4, 321, 969	4, 396, 581	530, 623, 945	120. 69												
Grand total, 1945	5, 030, 336	4, 162, 588	4, 195, 732	435, 184, 395	103. 72												
Increase, 1945–46 total	120, 495	159, 381	200, 849	95, 439, 550	16. 97												

NOTE.—Per acre value based on net area in cultivation.

[1] Area for which the Bureau is prepared to supply water.

[2] Generally part of irrigable area but not subject to construction charges until reclaimed.

[3] Private projects reconstructed with Government funds.

[4] Water conservation and utilization project.

[5] Includes 827 acres irrigated, mostly in small tracts, for which no crops reports were received. Per acre value based on 704 acres in cultivation.

[6] Although there are 178,015 acres that can be irrigated within project limits, the area for which there is considered to be a safe and reliable water supply is 155,000 acres.

[7] Includes the Arnold and Lone Pine irrigation districts, Deschutes project; certain lands on Klamath project: and Indian reservation lands of Pine River project.

Crop production on Federal reclamation projects in calendar year 1946

REGULAR PROJECTS

State	Project	Cereals							Seed			
		Barley	Corn	Oats	Rye	Wheat	Other	Total	Alfalfa	Clover	Other	Total
		Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Arizona	Salt River	1, 741, 946	0	173, 644	0	301, 033	1, 426, 275	3, 642, 898	13, 720	0	398, 577	412, 297
	Gila	0	0	0	0	0	0	0	246	0	1, 419	1, 665
Arizona-California	Yuma	100, 710	16, 599	2, 600	0	25, 847	212, 162	357, 918	18, 078	0	413, 699	431, 777
California	Orland	2, 977	0	876	0	26	21, 241	25, 120	132	504	0	636
Colorado	Grand Valley	30, 868	130, 579	44, 997	40	23, 586	0	230, 070	795	752	5, 082	6, 629
	Uncompahgre	152, 903	127, 230	221, 471	0	150, 594	1, 460	653, 658	235	5, 161	1, 926	7, 322
Idaho	Boise	329, 645	129, 553	253, 509	690	494, 552	214, 799	1, 422, 748	2, 755	31. 613	355, 569	389, 937
	Minidoka	362, 021	12, 788	326, 057	0	1, 093, 534	7, 068	1, 801, 468	1, 535	25, 320	117. 319	144, 174
Montana	Bitter Root	50, 560	550	38, 321	0	27, 758	0	117, 189	190	548	6, 730	7, 468
	Frenchtown	11, 083	0	12, 653	0	15, 450	0	39, 186	7	0	1, 482	1, 489
	Huntley	31, 910	5, 030	53, 316	0	53, 522	1, 266	145, 044	1, 158	199	31, 070	32, 427
	Milk River	169, 466	1, 920	201, 258	0	109, 226	0	481, 870	2, 724	16	3, 220	5, 960
	Sun River	268, 810	710	246, 954	101	539, 780	7, 415	1, 063. 770	78	14, 598	66, 325	81, 001
Montana-North Dakota	Lower Yellowstone	129, 568	12, 190	308, 742	0	152, 629	1, 750	604, 879	186	71	6, 160	6, 417
Nebraska-Wyoming	North Platte	1, 128, 865	226, 575	181, 715	6, 903	22, 227	0	1, 566, 285	277	178	150	605
Nevada	Newlands	128, 750	9, 136	9, 356	753	235, 699	0	383, 694	20	0	0	20
New Mexico	Carlsbad	12, 965	745	31, 801	390	6, 187	0	52, 088	6, 868	0	6, 306	13, 174
	Tucumcari	504	6, 194	400	0	10, 439	12, 172	29, 709	0	0	1, 350	1, 350
New Mexico-Texas	Rio Grande	10, 449	67, 380	9, 314	0	10, 450	1, 594	99, 187	64, 161	0	62, 221	126, 382
Oklahoma	Altus	0	0	0	0	0	2, 472	2, 472	0	0	33	33
Oregon	Deschutes (north unit)	32, 952	430	5, 694	295	32, 558	1, 586	73, 515	20	0	7, 787	7, 807
	Umatilla	1, 137	10, 420	6, 560	890	1, 302	0	20, 309	43	66	0	109
	Vale	102, 128	13, 328	25, 496	1, 783	97, 386	210	240, 331	581	6, 261	651	7, 493
Oregon-California	Klamath	882, 040	0	42, 620	8, 617	109, 683	0	1, 042, 960	200	37, 243	2. 582	40, 025
Oregon-Idaho	Owyhee	312, 208	45, 426	72, 631	1, 464	268, 161	33, 748	733, 638	1, 899	10, 579	135, 954	148, 432
South Dakota	Belle Fourche	384, 534	75, 378	198, 655	2, 706	110, 297	1, 230	772, 800	1, 000	10	252	1, 262
Utah	Strawberry Valley	238, 578	4, 330	49, 600	540	198, 216	0	491, 264	573	15	138	726
Washington	Okanogan	0	1, 063	0	0	0	0	1, 063	0	0	0	0
	Yakima	154, 984	211, 675	434, 469	5, 104	294, 370	1, 144	1, 101, 747	513	1, 453	44, 151	46, 117
Wyoming	Kendrick	81	50	3, 519	21	1, 533	0	5, 204	15	0	5	20
	Riverton	117, 625	3, 405	175, 990	120	54, 425	1, 705	353, 270	1, 224	7, 112	2, 182	10, 518
	Shoshone	73, 858	2, 556	200, 185	90	44, 428	0	321, 127	863	2, 574	73, 481	76, 918
	Subtotal	6, 964, 125	1, 115, 240	3, 332, 403	30, 508	4, 484, 908	1, 949, 297	17, 876, 481	120, 096	144. 273	1, 745, 821	2, 010, 190

SUPPLEMENTAL STORAGE PROJECTS

Colorado	Fruitgrowers Dam	4, 485	17, 215	725	0	85	0	22, 510	12	0	0	12
	Pine River	29, 569	5, 322	63, 600	715	76, 751	437	176, 394	466	4, 799	10	5, 275
Idaho	Minidoka (Fremont-Madison irrigation district).	108, 784	0	256, 480	4, 000	699, 503	0	1, 068, 767	0	82	141, 399	141, 481
Nevada	Humboldt	114, 513	472	9, 024	224	194, 313	0	318, 546	0	0	0	0
	Truckee River Storage [1]	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Oregon	Baker	43, 554	0	1, 610	0	1, 920	0	47, 084	0	0	0	0
	Burnt River	45. 240	1, 450	4, 900	0	18, 490	0	70. 080	14	23	0	37
	Deschutes (Central Oregon irrigation district.)	144, 070	320	80, 432	8, 874	61, 646	0	295. 342	89	9, 945	7, 839	17, 873
	Stanfield	7, 140	5. 054	9, 612	484	9, 875	48	32. 213	9	0	85	94
	Westland	2, 470	6, 065	2, 072	648	1, 072	0	12. 327	125	0	0	125
Utah	Hyrum	39, 245	0	535	0	35, 386	0	75, 166	15	18	0	33
	Moon Lake	46, 606	13, 601	53, 898	0	54, 031	580	168, 716	1, 774	718	0	2, 492
	Ogden River	42, 268	3, 250	10, 880	0	47, 326	0	103, 724	195	0	0	195
	Provo River (Deer Creek division)	66, 831	16, 700	46, 445	0	152, 961	0	282. 937	0	0	0	0
	Sanpete	22, 272	0	19, 058	30	18, 599	0	59, 959	8	0	0	8
	Weber River	632, 320	0	92, 100	0	221, 400	0	945, 820	0	0	61, 920	61, 920
	Subtotal	1, 349, 367	69, 449	651, 371	14, 975	1, 593, 358	1, 065	3, 679, 585	2. 707	15, 585	211, 253	229, 545

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho	Rathdrum Prairie (Post Falls unit)	0	850	100	0	100	0	1, 050	0	0	477	477
Montana	Buffalo Rapids	112, 273	4, 333	32, 428	0	27, 159	44	176, 237	64	0	2, 111	2, 175
	Intake	2, 050	0	450	0	0	0	2, 500	0	0	114	114
Nebraska	Mirage Flats	13, 740	22, 545	2, 730	130	9, 701	0	48, 846	0	0	0	0
North Dakota	Buford-Trenton	10, 042	1, 942	5, 279	0	55, 057	0	72. 320	0	0	217	217
Utah	Newton	18, 367	54	330	0	9, 452	0	28, 203	7	0	0	7
	Scofield	52, 325	4, 500	42, 000	0	30, 546	0	129, 371	150	0	0	150
	Subtotal	208, 797	34, 224	83, 317	130	132, 015	44	458. 527	221	0	2, 919	3, 140
	Grand total	8, 522, 289	1, 218, 913	4, 067, 091	45, 613	6, 210, 281	1, 950, 406	22, 014, 593	123, 024	159, 858	1, 959, 993	2, 242, 875

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[1] No data reported.

Crop production on Federal reclamation projects in calendar year 1946—Continued

REGULAR PROJECTS

State	Project	Hay and forage					Vegetables and truck					
		Alfalfa	Other hay	Corn fodder	Other forage	Total	Beans	Onions	Potatoes		Truck	Total
									White	Sweet		
		Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
Arizona	Salt River	270, 068	76, 783	0	106, 287	453, 138	0	202, 400	46, 480	118, 846	12, 210, 018	12, 577, 744
	Gila	6, 529	0	0	0	6, 529	0	0	5, 216	0	120	5, 336
Arizona-California	Yuma	30, 380	122	0	2, 029	32, 531	0	160	0	0	7, 365, 249	7, 365, 409
California	Orland	11, 130	3, 134	4, 133	0	18, 397	88	0	1, 100	0	2, 888	4, 076
Colorado	Grand Valley	20, 664	500	1, 731	3, 417	26, 312	38, 005	56, 000	229, 070	0	181, 265	504, 340
	Uncompahgre	32, 250	3, 334	3, 840	12, 024	51, 448	89, 120	207, 427	432, 046	0	63, 865	792, 458
Idaho	Boise	164, 015	7, 258	16, 639	6, 199	194, 111	57, 301	860, 391	1, 549, 831	2, 108	899, 463	3, 369, 094
	Minidoka	179, 981	2, 394	18	525	182, 918	363, 328	2, 400	4, 373, 383	0	0	4, 739, 111
Montana	Bitter Root	9, 787	2, 663	8	24	12, 482	0	0	10, 153	0	1, 214	11, 367
	Frenchtown	2, 304	322	0	0	2, 626	0	0	0	0	0	0
	Huntley	9, 696	371	265	--------	10, 332	10, 518	0	1, 433	0	569	12, 520
	Milk River	36, 488	7, 884	557	0	44. 929	0	0	160, 101	0	0	160, 101
	Sun River	25, 097	1, 232	567	2, 126	29, 022	0	0	51, 728	0	0	51, 728
Montana-North Dakota	Lower Yellowstone	18, 576	450	937	5, 608	25, 571	1, 190	280	78, 720	0	0	80, 190
Nebraska-Wyoming	North Platte	63, 781	1, 616	2, 554	759	68, 710	1, 131, 621	0	3, 406, 471	0	67, 663	4, 605, 755
Nevada	Newlands	65, 820	655	0	4, 320	70, 795	0	3, 275	18, 582	0	5, 296	27, 153
New Mexico	Carlsbad	15, 927	4, 086	0	0	20, 013	0	0	0	0	0	0
	Tucumcari	39	3, 000	518	0	3, 557	3, 066	0	0	0	3, 440	6, 506
New Mexico-Texas	Rio Grande	151, 741	1, 291	3, 977	455	157, 464	783	280, 493	75, 592	25, 538	353, 738	736, 144
Oklahoma	Altus	30	16	0	0	46	0	0	200	650	82	932
Oregon	Deschutes (north unit)	10	136	2	2, 285	2, 433	0	800	59, 048	0	0	59, 848
	Umatilla	7, 059	1, 517	912	500	9, 988	0	200	41, 419	0	49, 320	90, 939
	Vale	27, 154	431	257	1, 259	29, 101	24	161, 540	531, 503	700	80, 770	714, 537
Oregon-California	Klamath	32, 474	2, 903	0	377	35, 754	0	233, 876	5, 678, 326	0	0	5, 912, 202
Oregon,Idaho	Owyhee	91, 803	1, 006	951	123	93, 883	8, 186	689, 091	2, 588, 172	0	419, 053	3, 704, 502
South Dakota	Belle Fourche	15, 178	4, 260	1, 291	--------	20, 729	300	0	27, 907	0	10, 581	38, 788
Utah	Strawberry Valley	32, 393	1, 123	1, 785	13, 484	48, 785	0	20, 460	29, 426	0	373, 611	423, 497
Washington	Okanogan	1, 275	261	61	0	1, 597	0	0	2, 772	0	0	2, 772
	Yakima	133, 491	34, 553	19, 507	26, 659	214, 210	1, 147	292, 302	4, 234, 776	0	2, 555, 050	7, 083, 275
Wyoming	Kendrick	200	45	4	0	249	0	0	250	0	0	250
	Riverton	9, 283	523	615	20, 605	31, 026	203, 332	0	101, 458	0	90	304, 880
	Shoshone	14, 719	68	261	--------	15, 048	338, 143	0	118, 162	0	49, 487	505, 792
	Subtotal	1, 479, 342	163, 937	61, 390	209, 065	1, 913, 734	2, 246, 152	3, 011, 095	23, 853, 325	147, 842	24, 692, 832	53, 951, 246

SUPPLEMENTAL STORAGE PROJECTS

Colorado	Fruitgrowers Dam	1, 987	4	0	0	1, 991	0	0	450	0	17, 472	17, 922
	Pine River	11, 868	1, 989	213	5, 000	19, 070	0	24	1, 670	305	500	2, 499
Idaho	Minidoka (Fremont-Madison irrigation district).	65, 718	1, 700	0	0	67, 418	0	0	4, 463, 200	0	0	4, 463, 200
Nevada	Humboldt	35, 375	0	0	1, 569	36, 944	0	31, 579	76, 420	0	0	107, 999
	Truckee River storage [1]	---	---	---	---	---	---	---	---	---	---	---
Oregon	Baker	2, 208	4, 295	0	0	6, 503	0	0	0	0	0	0
	Burnt River	5, 881	12, 712	0	0	18, 593	0	0	12, 857	0	0	12, 857
	Deschutes (Central Oregon irrigation district.).	22, 813	3, 808	0	2, 386	29, 007	0	19, 392	1, 905, 873	0	0	1, 925, 265
	Stanfield	4, 533	172	0	296	5, 001	0	0	17, 480	0	8, 690	26, 170
	Westland	3, 439	279	85	---	3, 803	4, 634	0	0	0	10, 837	15, 471
Utah	Hyrum	4, 364	146	60	269	4, 839	610	0	9, 758	0	27, 124	37, 492
	Moon Lake	12, 735	7, 000	2, 778	825	23, 338	0	0	5, 733	0	0	5, 733
	Ogden River	17, 088	474	1, 096	430	19, 088	0	40, 395	58, 842	0	175, 429	274, 666
	Provo River (Deer Creek division)	37, 800	3, 775	105	7, 609	49, 289	3, 975	84, 250	294, 125	0	416, 000	798, 350
	Sanpete	7, 028	300	0	0	7, 328	0	0	3, 000	0	17, 339	20, 339
	Weber River	96, 443	3, 860	0	23, 210	123, 513	0	815, 100	618, 800	0	2, 680, 605	4, 114, 505
	Subtotal	329, 280	40, 514	4, 337	41, 594	415, 725	9, 219	990, 740	7, 468, 208	305	3, 353, 996	11, 822, 468

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho	Rathdrum Prairie (Post Falls unit)	289	86	112	0	487	291	0	335	0	1, 470	2, 096
Montana	Buffalo Rapids	3, 674	215	2, 881	0	6, 770	2, 916	305	22, 873	0	11, 064	37, 158
	Intake	85	100	62	0	247	0	0	0	0	489	489
Nebraska	Mirage Flats	0	0	0	0	0	11, 906	0	59, 800	0	0	71, 706
North Dakota	Buford-Trenton	1, 164	102	46	---	1, 312	0	0	10, 509	0	0	10, 509
Utah	Newton	2, 581	12	148	179	2, 920	0	0	675	0	5, 133	5, 808
	Scofield	12, 700	0	0	5, 621	18, 321	3, 570	0	26, 300	0	0	29, 870
	Subtotal	20, 493	515	3, 249	5, 800	30, 057	18, 683	305	120, 492	0	18, 156	157, 636
	Grand total	1, 829, 115	204, 966	68, 976	256, 459	2, 359, 516	2, 274, 054	4, 002, 140	31, 442, 025	148, 147	28, 064, 984	65, 931, 350

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[1] No data reported.

Crop production on Federal reclamation projects in calendar year 1946—Continued

REGULAR PROJECTS

State	Project	Fruits and nuts								Miscellaneous		
		Apples	Peaches	Pears	Prunes	Citrus fruits	Small fruits	Miscellaneous	Total	Sugar beets	Cotton	
											Lint	Seed
		Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Tons*	*Bales*	*Tons*
Arizona	Salt River	0	60, 000	189, 000	0	197, 255, 146	6, 654, 500	1, 395, 000	205, 553, 646	0	3, 008	1, 244
	Gila	0	0	0	0	492, 500	0	0	492, 500	0	0	0
Arizona-California	Yuma	0	0	0	0	39, 370, 112	165, 481	137, 420	40, 173, 013	0	0	0
California	Orland	0	419, 028	0	153, 780	3, 430, 400	2, 926, 275	1, 581, 062	8, 510, 545	0	0	0
Colorado	Grand Valley	4, 000	26, 393, 000	36, 000	0	0	513, 480	0	26, 946, 480	15, 333	0	0
	Uncompahgre	872, 160	1, 123, 485	0	850	0	139, 530	0	2, 136, 025	20, 119	0	0
Idaho	Boise	5, 605, 325	7, 818, 628	1, 139, 740	11, 998, 928	0	1, 447, 222	0	28, 009, 843	258, 564	0	0
	Minidoka	0	0	0	0	0	0	0	0	206, 050	0	0
Montana	Bitter Root	8, 000	0	0	3, 540	0	32, 225	0	43, 765	3, 859	0	0
	Frenchtown	0	0	0	0	0	0	0	0	3, 114	0	0
	Huntley	0	0	0	0	0	0	0	0	40, 133	0	0
	Milk River	0	0	0	0	0	0	0	0	101, 108	0	0
	Sun River	0	0	0	0	0	0	0	0	6, 852	0	0
Montana-North Dakota	Lower Yellowstone	0	0	0	0	0	0	0	0	164, 722	0	0
Nebraska-Wyoming	North Platte	0	0	0	0	0	0	0	0	368, 950	0	0
Nevada	Newlands	172, 350	70, 572	7, 000	0	0	0	153, 200	403, 122	0	0	0
New Mexico	Carlsbad	0	0	0	0	0	0	2, 000	2, 000	0	6, 264	2, 648
	Tucumcari	0	0	0	0	0	0	0	0	0	9	2
New Mexico-Texas	Rio Grande	226, 153	118, 650	144, 117	0	0	60, 335	598, 050	1, 147, 305	14	153, 273	59, 740
Oklahoma	Altus	0	0	0	0	0	0	0	0	0	264	119
Oregon	Deschutes (north unit)	0	0	0	0	0	3, 600	0	3, 600	0	0	0
	Umatilla	37, 920	43, 700	320	2, 550	0	92, 095	0	176, 655	0	0	0
	Vale	21, 665	15, 640	0	600	0	3, 480	0	41, 385	28, 240	0	0
Oregon-California	Klamath	0	0	0	0	0	0	0	0	5, 630	0	0
Oregon-Idaho	Owyhee	1, 055, 060	93, 080	0	196, 828	0	7, 000	----------	1, 351, 968	284, 880	0	0
South Dakota	Belle Fourche	10, 000	0	0	0	0	0	0	10, 000	58, 273	0	0
Utah	Strawberry Valley	706, 224	1, 732, 368	241, 100	132, 496	0	1, 258, 789	----------	4, 070, 977	30, 599	0	0
Washington	Okanogan	64, 101, 780	102, 583	662, 081	2, 000	0	201, 904	0	65, 070, 348	0	0	0
	Yakima	298, 196, 102	45, 171, 256	125, 466, 941	17, 805, 969	0	54, 832, 174	4, 740	541, 477, 182	58, 944	0	0
Wyoming	Kendrick	0	0	0	0	0	0	0	0	0	0	0
	Riverton	0	0	0	0	0	0	0	0	9, 671	0	0
	Shoshone	183, 665	0	0	0	0	0	0	183, 665	24, 342	0	0
	Subtotal	371, 200, 404	83, 162, 060	127, 886, 299	30, 297, 541	241, 048, 158	68, 338, 090	3, 871, 472	925, 804, 024	1, 689, 397	162, 818	63, 753

SUPPLEMENTAL STORAGE PROJECTS

Colorado	Fruitgrowers Dam	774, 480	1, 449, 904	31, 443	45, 240	0	50, 791	0	2, 351, 858	600	0	0
	Pine River	2, 500	0	0	0	0	0	0	2, 500	0	0	0
Idaho	Minidoka (Fremont-Madison irrigation district).	0	0	0	0	0	0	0	0	13, 772	0	0
Nevada	Humboldt	0	0	0	0	0	0	0	0	0	0	0
	Truckee River storage [1]	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------
Oregon	Baker	0	0	0	0	0	0	0	0	0	0	0
	Burnt River	24, 000	71, 500	0	0	0	27, 500	0	123, 000	0	0	0
	Deschutes (Central Oregon irrigation district).	0	0	0	0	0	72, 000	70, 000	142, 000	0	0	0
	Stanfield	0	0	0	0	0	0	0	0	0	0	0
	Westland	0	0	0	0	0	0	0	0	0	0	0
Utah	Hyrum	20, 400	2, 500	0	0	0	3, 600	0	26, 500	5, 376	0	0
	Moon Lake	64, 967	0	0	0	0	1, 755	0	66, 722	0	0	0
	Ogden River	684, 000	4, 597, 056	22, 500	231. 672	0	2, 502, 300	2, 804, 744	10, 842, 272	11, 653	0	0
	Provo River (Deer Creek division).	12, 076, 500	25, 632, 150	2, 717. 000	615, 250	0	6, 513, 100	0	47, 554, 000	18, 895	0	0
	Sanpete	0	0	0	0	0	0	0	0	0	0	0
	Weber River	12, 252, 500	19, 350, 000	633, 500	279, 000	0	11, 244, 000	---------	43, 759, 000	114, 407	0	0
	Subtotal	25, 899. 347	51, 103, 110	3, 404, 443	1, 171, 162	0	20. 415, 046	2, 874, 744	104, 867, 852	164, 703	0	0

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho	Rathdrum Prairie (Post Falls unit).	132, 000	0	0	0	0	440	0	132, 440	0	0	0
Montana	Buffalo Rapids	0	0	0	0	0	0	0	0	37, 200	0	0
	Intake	0	0	0	0	0	0	0	0	928	0	0
Nebraska	Mirage Flats	0	0	0	0	0	0	0	0	0	0	0
North Dakota	Buford-Trenton	0	0	0	0	0	0	0	0	3, 744	0	0
Utah	Newton	0	0	0	0	0	0	0	0	598	0	0
	Scofield	96, 074	159, 600	19, 998	19, 796	0	0	0	295, 468	6, 000	0	0
	Subtotal	228, 074	159, 600	19, 998	19, 796	0	440	0	427, 908	48, 470	0	0
	Grand total	397, 327, 825	134, 424, 770	131, 310, 740	31, 488, 499	241, 048. 158	88, 753, 576	6, 746, 216	1, 031, 099, 784	1, 902, 570	162, 818	63, 753

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[1] No data reported.

Crop values on Federal reclamation projects, 1946

REGULAR PROJECTS

State and project	Cereals							Seed				Hay and forage		
	Barley	Corn	Oats	Rye	Wheat	Other	Total	Alfalfa	Clover	Other	Total	Alfalfa	Other hay	Corn fodder
Arizona:														
Salt River	$2, 349, 537	0	$158, 363	0	$614, 108	$2,116,592	$5, 238, 600	$296, 352	0	$1,017,880	$1, 314, 232	$7, 021, 768	$1,689,226	0
Gila	0	0	0	0	0	0	0	6, 812	0	5, 619	12, 431	165, 500	0	0
Arizona-California: Yuma	130, 923	$24, 069	2, 210	0	54, 279	250, 351	461, 832	390, 485	0	1, 638, 257	2, 028, 742	820, 260	1, 508	0
California: Orland	3, 721	0	876	0	41	33, 886	38, 524	2, 783	$36, 273	0	39, 056	222, 600	47, 010	$30, 997
Colorado:														
Grand Valley	39, 202	201, 092	38, 247	$44	42, 455	0	321, 040	17, 411	19, 853	63, 293	100, 557	413, 280	8, 000	17, 310
Uncompahgre	183, 484	159, 038	155, 030	0	257, 516	1, 752	756, 820	4, 230	99, 091	25, 010	128, 331	516, 000	44, 368	38, 400
Idaho:														
Boise	381, 249	194, 700	212, 647	690	800, 508	272, 175	1, 861, 969	63, 302	657, 560	1, 443, 646	2, 164, 508	2, 783, 113	66, 564	98, 029
Minidoka	390, 983	17, 231	251, 064	0	1, 815, 267	7, 608	2, 481, 613	38, 901	624, 203	512, 300	1, 175, 404	2, 910, 804	38, 475	144
Montana:														
Bitter Root	56, 627	825	29, 507	0	44, 690	0	131, 649	2, 850	5, 480	21, 224	29, 554	195, 740	39, 945	80
Frenchtown	12, 745	0	10, 122	0	24, 720	0	47, 587	200	0	4, 891	5, 091	36, 864	4, 830	0
Huntley	33, 506	6, 539	37, 321	0	83, 494	1, 266	162, 126	25, 476	3, 980	127, 564	157, 020	145, 440	3, 339	2, 650
Milk River	194, 886	2, 304	150, 944	0	191, 145	0	539, 279	80, 086	104	13, 283	93, 473	656, 784	136, 192	6, 127
Sun River	290, 315	887	190, 155	252	917, 626	5, 735	1, 404, 970	2, 185	79, 090	267, 712	348, 987	376, 455	9, 240	2, 268
Montana-North Dakota: Lower Yellowstone	116, 611	9, 752	185, 245	0	271, 680	1, 137	584, 425	3, 906	426	17, 634	21, 966	167, 652	2, 700	3, 280
Nebraska-Wyoming: North Platte	1, 130, 434	230, 155	118, 664	12, 522	38, 395	0	1, 530, 170	6, 094	1, 541	165	7, 800	885, 922	14, 961	11, 623
Nevada: Newlands	180, 250	14, 892	8, 701	1, 227	438, 400	0	643, 470	400	0	0	400	1, 316, 400	10, 480	0
New Mexico:														
Carlsbad	16, 206	1, 117	28, 621	546	9. 652	0	56, 142	131, 864	0	8, 346	140, 210	445, 956	89, 922	0
Tucumcari	474	7, 866	320	0	19, 729	15, 459	43, 848	0	0	2, 160	2, 160	1, 443	90, 012	13, 973
New Mexico-Texas: Rio Grande	16, 742	134, 780	13, 117	0	20, 319	2, 023	186, 981	230, 157	0	164, 227	394, 384	4, 162, 802	24, 357	36, 706
Oklahoma: Altus	0	0	0	0	0	3, 213	3, 213	0	0	1, 500	1, 500	750	310	0
Oregon:														
Deschutes (north unit)	49, 428	1, 075	5, 694	516	60, 233	2, 696	119, 642	720	0	18, 689	19, 409	200	2, 040	30
Umatilla	1, 501	22, 128	6, 059	1, 495	2, 200	0	33, 383	1, 419	3, 960	0	5, 379	141, 180	21, 329	6, 888
Vale	162, 384	21, 991	24, 476	2, 675	163, 608	315	375, 449	14, 990	169, 047	7, 828	191, 865	434, 464	4, 690	2, 750
Oregon-California: Klamath	1, 579, 349	0	36, 648	13, 997	192, 468	0	1, 822, 462	5, 040	899, 489	6, 303	910, 832	804, 659	58, 116	0
Oregon-Idaho: Owyhee	337, 184	50, 877	58, 105	2, 123	418, 331	41, 173	907, 793	42, 727	237, 102	321, 185	601, 014	1, 422, 945	12, 575	4, 755
South Dakota: Belle Fourche	419, 142	94, 976	117, 206	5, 412	196, 329	1, 538	834, 603	27, 600	66	529	28, 195	182, 136	42, 600	11, 619
Utah: Strawberry Valley	262, 436	6, 495	43, 648	810	336, 968	0	650, 357	10, 314	90	276	10, 680	583, 074	14, 646	1, 338
Washington:														
Okanogan	0	1, 862	0	0	0	0	1, 862	0	0	0	0	26, 373	4, 372	845
Yakima	199, 101	296, 344	376, 983	8, 628	498, 687	1, 810	1, 381, 553	11, 976	27, 671	133, 405	173, 052	2, 354, 731	470, 905	229, 016
Wyoming:														
Kendrick	92	50	2, 780	35	2, 713	0	5, 670	300	5	40	340	4, 000	450	20
Riverton	119, 977	4, 665	161, 911	151	78, 372	1, 997	367, 073	24, 235	38, 400	12, 015	74, 655	139, 245	8, 109	6, 150
Shoshone	79, 766	3, 195	180, 166	140	70, 656	0	333, 923	20, 712	28, 602	406, 082	455, 396	220, 785	340	3, 915

SUPPLEMENTAL STORAGE PROJECTS

Colorado:														
Fruitgrowers Dam	$5,920	$22,724	$819	0	$150	0	$29,613	$263	0	0	$263	$39,521	$40	0
Pine River	36,666	6,653	63,600	$894	95,939	$437	204,189	11,650	$26,395	$50	38,095	237,360	39,780	$1,704
Idaho: Minidoka (Fremont-Madison irrigation district)	125,102	0	210,313	6,000	1,161,175	0	1,502,590	0	1,935	537,316	539,251	985,770	25,500	0
Nevada:														
Humboldt	151,157	807	7,941	383	378,910	0	539,198	0	0	0	0	813,625	0	0
Truckee River storage [1]														
Oregon:														
Baker	52,265	0	1,208	0	2,880	0	56,353	0	0	0	0	33,120	57,980	0
Burnt River	54,288	2,900	4,165	0	29,584	0	90,937	846	1,148	0	1,994	88,215	184,324	0
Deschutes (Central Oregon irrigation district)	172,884	1,120	76,410	13,311	104,798	0	368,523	2,136	209,486	37,487	249,109	515,997	75,147	0
Stanfield	7,854	5,054	7,209	726	15,800	72	36,715	216	0	620	836	81,594	2,064	0
Westland	3,508	6,975	1,968	920	2,069	0	15,440	4,500	0	0	4,500	55,024	4,185	595
Utah:														
Hyrum	39,245	0	321	0	53,079	0	92,645	261	324	0	585	78,552	1,752	360
Moon Lake	58,258	23,802	43,118	0	97,256	580	223,014	42,576	6,462	0	49,038	229,230	72,252	27,780
Ogden River	46,495	4,908	9,248	0	78,088	0	138,739	3,949	0	0	3,949	364,487	8,395	5,403
Provo River (Deer Creek Division)	80,197	25,050	40,872	0	275,330	0	421,449	0	0	0	0	831,600	75,500	788
Sanpete	28,234	0	20,558	54	34,408	0	83,254	199	0	0	199	140,560	3,000	0
Weber River	790,400	0	101,970	0	354,240	0	1,246,610	0	0	170,280	170,280	2,893,290	88,920	0
Subtotal	1,652,473	99,993	589,720	22,288	2,683,706	1,089	5,049,269	66,596	245,750	745,753	1,058,099	7,387,945	638,839	36,630

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho:														
Rathdrum Prairie (Post Falls unit)	0	$1,695	$60	0	$160	0	$1,915	0	0	$2,925	$2,925	$5,746	$1,335	$540
Montana:														
Buffalo Rapids	$124,661	5,416	22,231	0	48,481	$66	200,855	$1,536	0	7,654	9,190	58,439	2,757	20,738
Intake	2,358	0	270	0	0	0	2,628	0	0	410	410	1,275	1,500	620
Nebraska:														
Mirage Flats	16,488	33,817	1,911	$273	17,462	0	69,951	0	0	0	0	0	0	0
Buford Trenton	10,745	2,097	3,695	0	98,552	0	115,089	0	0	1,185	1,185	16,168	979	710
Utah:														
Newton	22,775	92	307	0	17,014	0	40,188	179	0	0	179	51,620	216	962
Scofield	52,325	9,450	50,400	0	61,092	0	173,267	3,240	0	0	3,240	266,700	0	0
Subtotal	229,352	52,567	78,874	273	242,761	66	603,893	4,955	0	12,174	17,129	399,948	6,787	23,570
Grand total	10,620,080	1,661,465	3,273,424	73,824	10,591,056	2,761,341	28,981,190	1,535,078	$3,177,783	6,998,990	11,711,851	37,347,218	3,607,237	588,933

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[1] No data reported.

Crop values on Federal reclamation projects, 1946—Continued

REGULAR PROJECTS

State and project	Hay and forage				Vegetables and truck							Fruits and nuts			
	Other forage	Beet tops	Pasture	Total	Beans	Onions	Potatoes		Truck	Garden	Total	Apples	Peaches	Pears	Prunes
							White	Sweet							
Arizona:															
Salt River	$2,650,278	0	$2,544,698	$13,905,970	0	$253,000	$127,820	$392,192	$12,006,988	$1,384,000	$14,164,000	0	$7,200	$17,010	0
Gila	0	0	16,924	182,424	0	0	15,588	0	125	0	15,713	0	0	0	0
Arizona-California: Yuma	28,406	0	127,194	977,368	0	320	0	0	7,223,023	4,055	7,227,398	0	0	0	0
California: Orland	0	0	523,401	824,008	$422	0	1,705	0	2,858	15,525	20,510	0	12,570	0	$18,453
Colorado:															
Grand Valley	12,497	$9,869	11,678	472,634	330,644	44,800	243,496	0	122,145	51,150	792,235	$160	1,187,685	1,440	0
Uncompahgre	20,549	12,771	117,266	749,354	561,456	41,485	427,726	0	56,230	26,690	1,113,587	26,165	33,705	0	111
Idaho:															
Boise	7,294	121,245	906,733	3,982,978	291,530	297,570	917,555	8,320	362,878	46,104	1,923,957	228,632	279,592	43,866	475,026
Minidoka	8,400	149,277	407,120	3,514,220	1,870,082	978	2,334,749	0	0	119,875	4,325,684	0	0	0	0
Montana:															
Bitter Root	960	1,930	57,001	295,656	0	0	11,270	0	1,590	11,976	24,836	640	0	0	230
Frenchtown	0	1,557	5,005	48,256	0	0	0	0	0	100	100	0	0	0	0
Huntley	13,286	31,242	36,850	232,807	50,486	0	1,935	0	2,560	8,514	63,495	0	0	0	0
Milk River	0	55,610	22,148	876,861	0	0	280,177	0	0	55,300	335,477	0	0	0	0
Sun River	4,375	3,426	73,624	469,388	0	0	72,419	0	0	32,250	104,669	0	0	0	0
Montana-North Dakota: Lower Yellowstone	11,216	16,472	9,877	211,197	4,998	560	73,647	0	0	29,591	108,796	0	0	0	0
Nebraska-Wyoming: North Platte	3,566	245,363	41,916	1,203,351	5,682,697	0	1,530,871	0	32,411	4,800	7,250,779	0	0	0	0
Nevada: Newlands	29,760	0	216,697	1,573,337	0	8,188	32,519	0	25,422	26,547	92,676	17,235	7,057	840	0
New Mexico:															
Carlsbad	0	0	2,190	538,068	0	0	0	0	0	6,300	6,300	0	0	0	0
Tucumcari	0	0	14,161	119,589	24,528	0	0	0	13,760	1,239	39,527	0	0	0	0
New Mexico-Texas: Rio Grande	7,695	0	237,111	4,468,671	5,543	184,975	89,176	57,413	889,374	251,467	1,477,948	9,082	8,362	7,971	0
Oklahoma: Altus	0	0	308	1,368	0	0	700	1,750	232	200	2,882	0	0	0	0
Oregon:															
Deschutes (north unit)	18,280	0	4,081	24,631	0	1,000	59,048	0	0	290	60,338	0	0	0	0
Umatilla	2,500	0	134,645	306,542	0	240	45,506	0	54,620	12,571	112,937	2,275	3,283	22	64
Vale	8,909	8,580	297,659	756,872	187	137,309	531,503	4,200	31,463	22,350	727,012	1,300	782	0	60
Oregon-California: Klamath	660	1,180	223,210	1,087,825	0	241,195	4,864,072	0	0	64,960	5,170,227	0	0	0	0
Oregon-Idaho: Owyhee	2,806	71,220	279,026	1,793,327	54,436	172,272	1,200,581	0	246,888	26,900	1,701,077	47,477	3,724	0	8,859
South Dakota: Belle Fourche	3,281	58,273	66,979	364,888	1,980	0	39,070	0	9,946	10,013	61,009	500	0	0	0
Utah: Strawberry Valley	51,315	15,299	35,504	701,176	0	16,368	20,598	0	362,549	11,520	411,035	14,124	51,972	12,054	5,300
Washington:															
Okanogan	0	0	9,043	40,633	0	0	4,173	0	0	8,000	12,173	2,684,560	4,249	30,942	74
Yakima	147,670	14,638	1,288,981	4,505,941	4,129	146,150	3,494,716	0	2,897,069	113,822	6,655,886	13,996,226	1,580,993	4,391,343	700,703

Wyoming:																
Kendrick	0	0	246	4, 716	0	0	300	0	0	460	760	0	0	0	0
Riverton	73, 071	7, 253	163, 357	397, 185	1, 067, 493	0	121, 749	0	180	21, 910	1, 211, 332	0	0	0	0
Shoshone	20, 276	18, 256	95, 251	358, 823	1, 724, 530	0	141, 794	0	42, 741	15, 870	1, 924, 935	7, 346	0	0	0
Subtotal	127, 050	843, 461	7, 969, 884	44, 990. 064	11, 675, 141	1, 546, 410	16, 684, 463	463, 875	24, 385, 052	2, 384, 349	57, 139, 290	17, 035, 722	3, 181, 174	4, 505, 488	1, 208, 880
SUPPLEMENTAL STORAGE PROJECTS															
Colorado:															
Fruitgrowers Dam	0	$350	$6, 655	$46, 566	0	0	$450	0	$11, 182	$1, 600	$13, 232	$24, 783	$46, 397	$2, 138	$1, 991
Pine River	$10, 000	0	121, 591	410, 435	0	$14	1, 670	$458	400	12, 700	15, 242	50	0	0	0
Idaho: Minidoka (Fremont-Madison irrigation district)	0	10, 329	265, 421	1, 287, 020	0	0	2, 677, 920	0	0	135, 750	2, 813, 670	0	0	0	0
Nevada:															
Humboldt	26, 997	0	91, 840	932, 462	0	41, 368	96, 289	0	0	1, 050	138, 707	0	0	0	0
Truckee River storage [1]															
Oregon:															
Baker	0	0	73, 340	164, 440	0	0	0	0	0	500	500	0	0	0	0
Burnt River	0	0	134, 699	407, 238	0	0	11. 571	0	0	4, 100	15, 671	1, 440	3, 575	0	0
Deschutes (Central Oregon irrigation district)	22, 717	0	367, 493	981, 354	0	16, 677	2, 287, 048	0	0	48, 577	2, 352, 302	0	0	0	0
Stanfield	4, 144	0	17, 412	105, 214	0	0	17, 480	0	20, 153	930	38, 563	0	0	0	0
Westland	650	0	39, 734	100, 188	$5, 792	0	0	0	19, 250	2, 398	27, 440	0	0	0	0
Utah:															
Hyrum	571	2, 652	20, 961	104, 848	1, 220	0	5, 855	0	29, 825	17, 400	54, 300	816	100	0	0
Moon Lake	2, 006	0	216, 291	547, 559	0	0	6, 880	0	0	41, 698	48, 578	1, 949	0	0	0
Ogden River	4, 021	784	32, 635	415, 725	0	32, 316	52, 605	0	130, 952	53, 098	268, 971	28, 318	132, 855	1, 199	8, 039
Provo River (Deer Creek Division)	79, 340	8, 930	128, 554	1, 124, 712	10, 931	84, 250	294, 125	0	416, 078	54, 087	859, 471	422, 677	833, 045	108, 680	24, 610
Sanpete	0	0	13, 702	157, 262	0	0	3, 000	0	34, 678	3, 100	40, 778	0	0	0	0
Weber River	236, 514	34, 460	299, 605	3, 552, 789	0	611, 325	556, 920	0	2, 168, 138	411, 250	3, 747, 633	735, 150	967, 500	31, 675	16, 740
Subtotal	386, 960	57, 505	1, 829, 933	10, 337, 812	17, 943	785, 950	6, 011, 813	458	2, 830, 656	788, 238	10, 435, 058	1, 215, 183	1, 983, 472	143, 692	51, 380
WATER CONSERVATION AND UTILIZATION PROJECTS															
Idaho:															
Rathdrum Prairie (Post Falls unit)	0	0	$2, 012	$9, 633	$1, 738	0	$335	0	$870	$1, 865	$4, 808	$3, 000	0	0	0
Montana:															
Buffalo Rapids	0	$27, 603	1, 185	110, 722	16, 332	$305	32, 022	0	23, 890	6, 300	78, 849	0	0	0	0
Intake	0	464	0	3, 859	0	0	0	0	235	0	235	0	0	0	0
Nebraska:															
Mirage Flats	0	0	0	0	71, 436	0	35, 880	0	0	0	107, 316	0	0	0	0
Buford Trenton	$584	1, 865	763	21, 069	0	0	13, 348	0	0	1, 020	14, 368	0	0	0	0
Utah:															
Newton	1, 292	0	900	54, 990	0	0	932	0	13, 243	2, 510	16, 685	0	0	0	0
Scofield	56, 210	5, 110	12, 500	340, 520	29, 988	0	31, 560	0	0	4, 800	66, 348	3, 843	$7, 980	$1, 400	$1, 782
Subtotal	58, 086	35, 042	17, 360	540, 793	119, 494	305	114, 077	0	38, 238	16, 495	288, 609	6, 843	7, 980	1, 400	1, 782
Grand total	3, 572, 096	936, 008	9, 817, 177	55, 868, 669	11, 812, 578	2, 332, 665	22, 810, 353	$464, 333	27, 253, 946	3, 189, 082	67, 862, 957	18, 257, 748	5, 172, 626	4, 650, 580	1, 262, 042

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[1] No data reported.

Crop values on Federal reclamation projects, 1946—Continued

REGULAR PROJECTS

State and project	Fruits and nuts				Miscellaneous					Sub-totals	Additional revenues			Grand total
	Citrus fruits	Small fruits	Miscel-laneous	Total	Sugar beets	Cotton		Other	Total		Govern-ment	Com-mercial	Total	
						Lint	Seed							
Arizona:														
Salt River	$3,912,145	$1,155,220	$488,250	$5,579,825	0	$567,514	$83,305	$46,935	$697,754	$40,900,381	$143,004	0	$143,004	$41,043,385
Gila	10,466	0		10,466	0	0	0	2,400	2,400	223,434	1,227	0	1,227	224,661
Arizona-California: Yuma	617,031	41,400	075,581	734,012	0	0	0	15,000	15,000	11,444,352	185,500	0	185,500	11,629,852
California: Orland	171,520	263,887	398,483	864,913	0	0	0	0	0	1,787,011	14,121	0	14,121	1,801,132
Colorado:														
Grand Valley	0	47,824	0	1,237,109	$159,567	0	0	300	159,867	3,083,442	37,793	0	37,793	3,121,235
Uncompahgre	0	9,227	0	69,208	200,385	0	0	0	200,385	3,017,685	110,965	$10,802	121,767	3,139,452
Idaho:														
Boise	0	109,768	0	1,136,884	2,678,723	0	0	198,706	2,877,429	13,947,725	662,651	2,391	665,042	14,612,767
Minidoka	0	0	0	0	2,120,254	0	0	0	2,120,254	13,617,175	511,089	0	511,089	14,128,264
Montana:														
Bitter Root	0	6,165	0	7,035	42,298	0	0	0	42,298	531,028	23,858	0	23,858	554,886
Frenchtown	0	0	0	0	37,461	0	0	0	37,461	138,495	14,324	0	14,324	152,819
Huntley	0	0	0	0	425,410	0	0	0	425,410	1,040,858	114,500	15,867	130,367	1,171,225
Milk River	0	0	0	0	1,061,638	0	0	0	1,061,638	2,906,728	308,673	19,875	328,548	3,235,276
Sun River	0	0	0	0	71,946	0	0	0	71,946	2,399,960	112,236	1,693	113,929	2,513,889
Montana-North Dakota: Lower Yellowstone	0	0	0	0	1,610,981	0	0	0	1,610,981	2,537,365	400,611	81,884	482,495	3,019,860
Nebraska-Wyoming: North Platte	0	0	0	0	3,728,902	0	0	0	3,728,902	13,721,002	743,160	48,065	791,225	14,512,227
Nevada: Newlands	0	0	15,302	40,434	0	0	0	1,825	1,825	2,352,142	123,672	0	123,672	2,475,814
New Mexico:														
Carlsbad	0	0	1,000	1,000	0	939,540	238,275	0	1,177,815	1,919,535	64,845	0	64,845	1,984,380
Tucumcari	0	0	0	0	0	1,125	161	0	1,286	206,410	9,699	0	9,699	216,109
New Mexico-Texas: Rio Grande	0	5,307	259,055	289,777	70	26,135,850	5,018,160	85,518	31,239,598	38,057,359	218,491	0	218,491	38,275,850
Oklahoma: Altus	0	0	0	0	0	36,960	13,031	0	49,991	58,954	0	0	0	58,954
Oregon:														
Deschutes (north unit)	0	900	0	900	0	0	0	0	0	224,920	4,804	0	4,804	229,724
Umatilla	0	6,866	0	12,510	0	0	0	33,600	33,600	504,351	3,768	0	3,768	508,119
Vale	0	522	0	2,664	292,566	0	0	10,170	302,736	2,356,598	58,200	296	58,496	2,415,094
Oregon-California: Klamath	0	0	0	0	62,268	0	0	0	62,268	9,053,614	118,796	0	118,796	9,172,410
Oregon-Idaho: Owyhee	0	8,710	14,980	83,750	2,951,357	0	0	7,000	2,958,357	8,045,318	515,715	2,876	518,591	8,563,909
South Dakota: Belle Fourche	0	0	0	500	631,097	0	0	0	631,097	1,920,292	138,239	0	138,239	2,058,531
Utah: Strawberry Valley	0	173,564	62,250	319,264	290,231	0	0	0	290,231	2,382,743	65,513	23,029	88,542	2,471,285
Washington:														
Okanogan	0	23,523	0	2,743,348	0	0	0	0	0	2,798,016	8,584	0	8,584	2,806,600
Yakima	0	4,294,183	1,422	24,964,870	604,176	0	0	5,064,634	5,668,810	43,350,112	297,628	5,234	302,862	43,652,974
Wyoming:														
Kendrick	0	0	0	0	0	0	0	0	0	11,486	205	0	205	11,691
Riverton	0	0	0	0	100,385	0	0	0	100,385	2,150,630	35,130	0	35,130	2,185,760
Shoshone	0	0	0	7,346	268,249	0	0	0	268,249	3,348,672	93,229	0	93,229	3,441,901
Subtotal	4,711,162	6,147,066	1,316,323	38,105,815	17,337,964	27,680,989	25,352,93	5,466,088	55,837,973	230,037,793	5,140,230	212,012	5,352,242	235,390,035

SUPPLEMENTAL STORAGE PROJECTS

SUPPLEMENTAL STORAGE PROJECTS

Coloroda:														
Fruitgrowers Dam	0	$3, 127	0	$78, 436	$6, 240	0	0	0	$6, 240	$174, 350	$1, 008	0	$1, 008	$175, 358
Pine River	0	0	0	50	0	0	0	0	0	668, 011	0	$16, 373	16, 373	684, 384
Idaho: Minidoka (Fremont-Madison irrigation district)	0	0	0	0	141, 714	0	0	0	141, 714	6, 284, 245	96, 439	0	96, 439	6, 380, 684
Nevada:														
Humboldt	0	0	0	0	0	0	0	0	0	1, 610, 367	37, 529	0	37, 529	1, 647, 896
Truckee River storage [1]														
Oregon:														
Baker	0	0	0	0	0	0	0	0	0	221, 293	5, 100	0	5, 100	226, 393
Burnt River	0	2, 460	0	7, 475	0	0	0	0	0	523, 315	9, 500	0	9, 500	532, 815
Deschutes (Central Oregon irrigation district)	0	925	$26, 630	27, 555	0	0	0	0	0	3, 978, 843	35, 000	0	35, 000	4, 013, 843
Stanfield	0	0	0	0	0	0	0	$43, 173	43, 173	224, 501	3, 703	0	3, 703	228, 204
Westland	0	0	0	0	0	0	0	9, 950	9, 950	157, 518	649	0	649	158, 167
Utah:														
Hyrum	0	900	0	1, 816	54, 029	0	0	1, 080	55, 109	309, 303	14, 895	0	14, 895	324, 198
Moon Lake	0	439	0	2, 388	0	0	0	0	0	870, 577	25, 000	0	25, 000	895, 577
Ogden River	0	167, 213	104, 475	442, 099	129, 348	0	0	0	129, 348	1, 398, 831	28, 167	0	28, 167	1, 426, 998
Provo River (Deer Creek Division)	0	1, 123, 698	0	2, 512, 710	188, 950	0	0	0	188, 950	5, 107, 292	20, 043	0	20, 043	5, 127, 335
Sanpete	0	0	0	0	0	0	0	0	0	281, 493	4, 500	0	4, 500	285, 993
Weber River	0	940, 290	210, 000	2, 901, 355	1, 154, 367	0	0	0	1, 154, 367	12, 773, 034	186, 371	0	186, 371	12, 959, 605
Subtotal	0	2, 239, 052	341. 105	5, 973. 884	1, 674, 648	0	0	54, 203	1, 728, 851	34, 582, 973	467, 904	16, 373	484, 277	35, 067, 250

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho:														
Rathdrum Prairie (Post Falls unit)	0	$62	0	$3, 062	0	0	0	0	0	$22, 343	0	0	0	$22, 343
Montana:														
Buffalo Rapids	0	0	0	0	$363, 816	0	0	0	$363, 816	763, 432	$81, 073	$16, 730	$97, 803	861, 235
Intake	0	0	0	0	9, 076	0	0	0	9, 076	16, 208	0	0	0	16, 208
Nebraska:														
Mirage Flats	0	0	0	0	0	0	0	0	0	177, 267	0	0	0	177, 267
Buford Trenton	0	0	0	0	38, 601	0	0	0	38, 601	190, 312	7, 530	971	8, 501	198, 813
Utah:														
Newton	0	0	0	0	6, 130	0	0	0	6, 130	118, 172	1, 051	0	1, 051	119, 223
Scofield	0	0	0	15, 005	59, 760	0	0	0	59, 760	658, 140	20, 010	0	20. 010	678, 150
Subtotal	0	62	0	18, 067	477, 383	0	0	0	477, 383	1, 945, 874	109, 664	17. 701	127, 365	2, 073, 239
Grand total	$4,711,162	8, 386, 180	$1,657,428	44, 097, 766	19, 489, 995	$27, 680, 989	$5, 352, 932	$5, 520, 291	58, 044, 207	266, 566, 640	5, 717, 798	246, 086	5, 963, 884	272, 530. 524

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[1] No data reported.

Average value for acre of crops on Federal reclamation projects, calendar year 1946

REGULAR PROJECTS

State	Project	Cereals							Seed				Hay and forage	
		Barley	Corn	Oats	Rye	Wheat	Other	Average	Alfalfa	Clover	Other	Average	Alfalfa	Other hay
Arizona	Salt River	$73.06	0	$59.85	0	$74.80	$71.55	$72.16	$72.00	0	$341.91	$185.29	$117.00	$55.00
	Gila	0	0	0	0	0	0	0	48.66	0	30.37	38.25	55.69	0
Arizona-California	Yuma	50.73	$29.46	34.00	0	62.03	74.58	60.02	78.81	0	95.26	91.58	84.84	15.71
California	Orland	38.36	0	26.55	0	41.00	58.12	53.96	42.17	$67.55	0	64.77	76.08	33.53
Colorado	Grand Valley	35.16	63.14	27.96	$14.67	44.09	0	48.39	50.32	83.42	111.43	87.29	54.66	22.54
	Uncompahgre	45.12	37.50	26.24	0	53.81	30.74	39.71	47.00	75.87	79.15	74.96	33.74	20.94
Idaho	Boise	46.34	72.76	40.13	27.60	63.07	56.36	55.17	63.43	92.21	171.09	130.65	58.82	12.91
	Minidoka	48.76	68.65	38.37	0	68.64	34.99	59.85	130.98	95.37	97.67	97.25	52.76	59.56
Montana	Bitter Root	44.31	82.50	31.16	0	49.06	0	41.85	31.67	40.00	27.78	29.82	43.58	22.72
	Frenchtown	46.68	0	47.97	0	35.93	0	40.60	10.00	0	55.58	47.14	38.32	28.08
	Huntley	38.96	44.18	29.60	0	44.25	28.13	38.59	18.39	57.68	68.40	47.30	33.71	10.34
	Milk River	37.02	44.31	30.80	0	39.48	0	35.81	23.31	13.00	40.13	24.77	37.90	15.44
	Sun River	36.81	29.57	31.00	16.80	45.13	27.18	40.59	24.83	30.29	55.14	46.20	25.76	7.91
Montana-North Dakota	Lower Yellowstone	30.98	21.96	31.17	0	48.48	17.23	36.94	25.36	35.50	22.90	23.47	18.67	5.79
Nebraska-Wyoming	North Platte	39.43	26.06	21.44	24.08	34.04	0	34.24	30.32	9.17	3.93	18.98	26.59	8.27
Nevada	Newlands	44.34	69.59	20.47	13.34	70.37	0	51.45	20.00	0	0	20.00	72.08	46.17
New Mexico	Carlsbad	32.15	38.52	26.11	27.30	34.47	0	29.10	29.81	0	57.16	30.68	60.96	54.53
	Tucumcari	14.81	48.26	6.40	0	35.94	43.18	38.06	0	0	43.20	43.20	55.50	156.00
New Mexico-Texas	Rio Grande	59.37	69.69	37.05	0	58.22	21.29	58.76	122.75	0	263.61	157.13	121.68	59.41
Oklahoma	Altus	0	0	0	0	0	39.67	39.67	0	0	187.50	187.50	57.69	25.83
Oregon	Deschutes (north unit)	24.52	21.94	26.24	39.69	26.56	58.61	25.96	36.00	0	19.43	19.57	10.00	13.25
	Umatilla	45.48	77.92	31.07	30.51	40.00	0	54.19	50.68	49.50	0	49.81	53.42	24.40
	Vale	62.03	54.70	41.70	39.93	65.79	52.50	60.88	78.48	70.17	57.99	70.15	54.73	6.37
Oregon-California	Klamath	108.03	0	53.50	57.60	74.37	0	100.49	173.79	166.66	57.30	164.53	98.45	37.25
Oregon-Idaho	Owyhee	45.07	40.28	33.72	22.83	59.48	52.52	49.40	52.17	63.36	190.05	96.15	56.48	9.64
South Dakota	Belle Fourche	34.06	37.25	23.96	53.06	43.26	39.44	34.17	41.38	8.25	58.78	41.22	17.82	9.68
Utah	Strawberry Valley	50.56	56.48	45.95	35.22	61.95	0	55.50	32.03	3.33	39.43	30.00	50.01	19.66
Washington	Okanogan	0	71.62	0	0	0	0	71.62	0	0	0	0	57.21	25.57
	Yakima	56.64	75.68	49.96	43.58	61.68	54.85	59.31	48.68	55.56	70.14	65.40	60.09	26.67
Wyoming	Kendrick	10.22	35.71	17.48	2.50	14.35	0	15.24	37.50	0	20.00	34.00	40.00	8.33
	Riverton	38.15	37.62	36.03	37.75	42.50	30.72	37.94	39.86	22.85	65.30	30.19	24.37	15.59
	Shoshone	33.63	26.40	28.21	28.00	37.56	0	31.02	38.43	38.76	88.13	77.38	24.39	3.37

SUPPLEMENTAL STORAGE PROJECTS

Colorado	Fruitgrowers Dam	$34.02	$90.90	$48.18	0	$37.50	0	$ 66.55	$32.88	0	0	$32.88	$71.34	$13.33
	Pine River	42.14	41.84	36.91	$40.64	26.50	$8.92	31.69	69.35	$33.67	$8.33	39.77	35.71	27.59
Idaho	Minidoka (Fremont-Madison irrigation district).	59.80	0	45.92	75.00	61.38	0	58.53	0	96.75	102.60	102.58	40.16	29.93
Nevada	Humboldt	63.35	57.64	35.14	54.71	58.50	0	59.19	0	0	0	0	78.11	0
	Truckee River Storage [2]	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Oregon	Baker	50.40	0	26.26	0	48.00	0	49.30	0	0	0	0	41.25	23.63
	Burnt River	51.90	111.54	52.06	0	54.79	0	53.75	16.92	37.03	0	24.62	33.90	25.15
	Deschutes (central Oregon irrigation district)	61.33	58.95	45.89	30.53	64.81	0	56.21	56.21	106.23	49.20	89.87	66.10	33.24
	Stanfield	38.50	38.00	27.00	16.50	40.00	18.00	35.07	13.50	0	51.67	29.86	54.00	10.81
	Westland	37.32	63.41	41.00	11.95	44.98	0	41.17	75.00	0	0	75.00	41.00	17.51
Utah	Hyrum	37.59	0	26.75	0	49.93	0	43.72	14.50	36.00	0	21.67	48.46	15.10
	Moon Lake	40.51	64.50	22.87	0	39.52	34.12	36.14	43.98	22.28	0	38.98	28.70	12.98
	Ogden River	57.19	83.19	50.54	0	66.51	0	62.24	31.59	0	0	31.59	71.98	42.83
	Provo River (Deer Creek division)	49.05	66.80	41.88	0	69.32	0	60.57	0	0	0	0	60.96	32.28
	Sanpete	33.29	0	38.28	27.00	51.28	0	40.45	19.90	0	0	19.90	25.43	15.00
	Weber River	95.00	0	99.00	0	86.40	0	92.68	0	0	473.00	473.00	99.00	37.84

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho	Rathdrum Prairie (Post Falls unit)	0	$94.17	$12.00	0	$45.71	0	$70.93	0	0	$47.95	$47.95	$32.10	$18.04
Montana	Buffalo Rapids	$23.99	23.55	18.18	0	30.08	$16.50	24.30	$5.63	0	11.16	9.58	23.13	11.30
	Intake	26.20	0	6.75	0	0	0	20.22	0	0	25.63	25.63	18.21	30.00
Nebraska	Mirage Flats	16.67	55.80	10.27	$21.00	64.67	0	33.89	0	0	0	0	0	0
North Dakota	Buford-Trenton	18.03	29.54	17.03	0	24.53	0	23.48	0	0	29.63	29.63	37.17	7.83
Utah	Newton	60.25	30.67	43.86	0	50.94	0	55.66	22.38	0	0	22.38	64.12	36.00
	Scofield	35.00	63.00	48.00	0	36.00	0	39.45	32.40	0	0	32.40	42.00	0
	Weighted averages	54.15	48.15	35.37	34.07	56.42	68.11	52.35	54.79	87.16	114.23	93.14	62.79	32.27

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[1] Includes additional payments received from Federal and commercial agencies.

[2] No data reported.

Average value for acre of crops on Federal reclamation projects, calendar year 1946—Continued

REGULAR PROJECTS—Continued

State	Project	Hay and forage					Vegetable and truck							Fruits and nuts
		Corn fodder	Other forage	Beet tops	Pasture	Average	Beans	Onions	Potatoes		Truck	Gardens	Average	Apples
									White	Sweet				
Arizona	Salt River	0	$84.14	0	$15.05	$47.73	0	$500.09	$770.00	$600.60	$248.31	$500.00	$270.06	0
	Gila	0	0	0	6.38	32.44	0	0	194.85	0	25.00	0	184.86	0
Arizona-California	Yuma	0	14.93	0	19.96	54.18	0	32.00	0	0	316.42	60.52	315.55	0
California	Orland	$117.86	0	0	57.02	59.81	$42.20	0	170.50	0	59.54	131.57	110.27	0
Colorado	Grand Valley	74.94	6.33	$7.81	3.16	31.33	164.34	222.89	185.31	0	97.56	110.00	151.07	$11.43
	Uncompahgre	70.85	1.33	8.25	3.06	10.23	84.00	37.54	202.52	0	148.76	85.00	105.12	59.47
Idaho	Boise	67.10	1.15	9.24	22.83	35.20	94.10	176.49	147.90	260.00	55.01	123.94	106.95	278.14
	Minidoka	24.00	12.00	11.64	12.70	34.65	151.34	17.16	119.97	0	0	125.00	131.74	0
Montana	Bitter Root	40.00	240.00	5.63	10.23	24.29	0	0	208.70	0	48.18	199.60	168.95	64.00
	Frenchtown	0	0	5.79	6.51	22.22	0	0	0	0	0	100.00	100.00	0
	Huntley	58.89	2.06	11.23	13.68	14.03	105.84	0	148.85	0	91.43	93.56	104.26	0
	Milk River	24.91	0	5.41	16.33	23.06	0	0	277.13	0	0	283.59	278.17	0
	Sun River	13.66	1.25	5.21	9.30	16.76	0	0	162.01	0	0	183.24	168.01	0
Montana-North Dakota	Lower Yellowstone	5.18	9.35	5.58	6.34	13.38	64.08	140.00	78.85	0	0	84.79	79.70	0
Nebraska-Wyoming	North Platte	17.04	16.74	9.40	3.68	14.57	134.74	0	90.32	0	59.25	36.36	121.23	0
Nevada	Newlands	0	30.49	0	6.07	27.45	0	174.21	277.94	0	651.85	118.51	217.04	292.12
New Mexico	Carlsbad	0	0	0	10.00	58.59	0	0	0	0	0	105.00	105.00	0
	Tucumcari	121.50	0	0	13.09	66.44	112.00	0	0	0	172.00	206.50	129.60	0
New Mexico-Texas	Rio Grande	103.69	15.27	0	86.00	115.50	120.50	206.91	325.46	259.79	269.18	109.76	198.01	139.72
Oklahoma	Altus	0	0	0	8.80	22.80	0	0	350.00	218.75	46.40	100.00	169.53	0
Oregon	Deschutes (north unit)	10.00	4.00	0	1.14	2.44	0	62.50	189.86	0	0	100.00	180.11	0
	Umatilla	43.59	100.00	0	21.82	31.06	0	480.00	176.38	0	140.77	91.76	144.05	105.81
	Vale	55.87	13.12	5.00	29.95	36.70	62.33	425.11	268.44	1,050.00	79.05	150.00	254.47	100.00
Oregon-California	Klamath	0	1.51	2.00	9.29	45.29	0	383.46	334.05	0	0	300.74	335.29	0
Oregon-Idaho	Owyhee	10.64	1.78	4.63	16.55	29.52	95.84	131.71	121.08	0	72.13	100.00	109.86	215.80
South Dakota	Belle Fourche	23.19	.75	10.64	2.34	6.81	165.00	0	135.66	0	111.75	75.29	116.88	55.56
Utah	Strawberry Valley	2.25	4.24	6.77	6.33	21.27	0	372.00	67.98	0	153.30	90.00	144.73	61.68
Washington	Okanogan	21.67	0	0	21.23	37.04	0	0	160.50	0	0	80.00	94.36	1,129.39
	Yakima	130.49	8.38	6.24	19.45	31.11	29.92	264.29	297.70	0	229.67	182.12	259.30	969.13
Wyoming	Kendrick	2.86	0	0	.92	8.57	0	0	25.00	0	0	51.11	36.19	0
	Riverton	26.62	3.57	8.32	6.01	7.23	128.34	0	152.19	0	10.59	78.25	128.66	0
	Shoshone	71.18	1.00	7.15	4.88	6.96	105.03	0	194.50	0	87.76	149.72	108.50	138.60

SUPPLEMENTAL STORAGE PROJECTS

Colorado	Fruitgrowers Dam	0	0	$10.00	$24.83	$54.15	0	0	$150.00	0	$192.79	$133.33	$181.26	$236.03
	Pine River	$32.15	$2.00	0	4.26	9.85	0	$14.00	72.61	$91.60	133.33	100.00	95.86	.26
Idaho	Minidoka (Fremont-Madison irrigation district).	0	0	8.25	21.17	32.84	0	0	120.00	0	0	125.00	120.23	0
Nevada	Humboldt	0	17.21	0	5.27	31.71	0	827.36	252.07	0	0	75.00	311.00	0
	Truckee River Storage [2]	---	---	---	---	---	---	---	---	---	---	---	---	---
Oregon	Baker	0	0	0	10.04	15.57	0	0	0	0	0	100.00	100.00	0
	Burnt River	0	0	0	9.07	16.43	0	0	148.35	0	0	100.00	131.69	480.00
	Deschutes (central Oregon irrigation district)	0	8.04	0	12.56	23.42	0	234.89	352.56	0	0	164.11	343.20	0
	Stanfield	0	56.00	0	10.83	28.83	0	0	190.00	0	48.21	30.00	71.28	0
	Westland	35.00	25.00	0	24.73	31.01	58.51	0	0	0	149.22	133.22	111.54	0
Utah	Hyrum	45.00	2.29	6.00	19.25	29.74	244.00	0	99.24	0	89.56	100.00	95.10	163.20
	Moon Lake	61.19	2.73	0	4.82	9.18	0	0	132.31	0	0	114.24	116.49	69.61
	Ogden River	34.63	87.41	2.83	11.78	48.86	0	577.07	259.14	0	186.01	70.14	156.38	387.92
	Provo River (Deer Creek division)	22.51	12.28	7.24	5.98	24.89	62.46	343.88	221.98	0	169.62	144.23	187.94	428.68
	Sanpete	0	0	0	1.43	10.26	0	0	100.00	0	102.60	25.83	83.56	0
	Weber River	0	16.96	5.00	6.50	36.06	0	627.00	187.20	0	201.50	175.00	219.67	1,014.00

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho	Rathdrum Prairie (Post Falls unit)	$22.50	0	0	$11.12	$21.03	$91.47	0	$60.91	0	$124.29	$119.55	$102.30	$300.00
Montana	Buffalo Rapids	30.92	0	$7.37	8.29	11.94	30.08	$152.50	165.06	0	268.43	100.00	88.49	0
	Intake	28.18	0	6.44	0	18.03	0	0	0	0	117.50	0	117.50	0
Nebraska	Mirage Flats	0	0	0	0	0	119.86	0	136.95	0	0	0	125.08	0
North Dakota	Buford-Trenton	20.29	$1.02	5.28	10.04	13.20	0	0	90.80	0	0	102.00	91.52	0
Utah	Newton	68.71	34.00	0	4.43	51.59	0	0	186.00	0	167.63	76.06	142.61	0
	Scofield	0	110.00	8.45	11.11	39.64	126.00	0	120.00	0	0	120.00	122.64	174.68
	Weighted averages	58.40	17.72	7.92	12.11	30.25	125.41	256.08	182.37	$503.07	229.45	190.53	186.02	842.22

Average value for acre of crops on Federal reclamation projects, calendar year 1946—Continued

REGULAR PROJECTS—Continued

State	Project	Fruits and nuts							Miscellaneous					Average for all crops [1]
		Peaches	Pears	Prunes	Citrus fruit	Small fruit	Miscellaneous	Average	Sugar beets	Cotton		Other	Average	
										Lint	Seed			
Arizona	Salt River	$300.00	$630.00	0	$343.80	$1,140.39	$1,750.00	$438.60	0	$173.45	$25.46	$250.99	$103.67	$179.62
	Gila	0	0	0	348.87	0	0	348.87	0	0	0	------	------	69.51
Arizona-California	Yuma	0	0	0	325.10	313.64	117.18	274.40	0	0	0	288.46	288.46	207.56
California	Orland	330.79	0	$131.81	522.93	327.40	179.90	245.23	0	0	0	0	0	107.63
Colorado	Grand Valley	464.85	120.00	0	0	376.57	0	354.68	126.24	0	0	300.00	126.38	111.68
	Uncompahgre	73.11	0	15.86	0	84.65	0	67.52	109.56	0	0	0	109.56	49.63
Idaho	Boise	237.34	232.10	311.70	0	315.43	0	279.95	192.94	0	0	867.71	203.88	85.71
	Minidoka	0	0	0	0	0	0	0	165.36	0	0	0	165.36	77.82
Montana	Bitter Root	0	0	115.00	0	411.00	0	8.88	123.32	0	0	0	123.32	33.63
	Frenchtown	0	0	0	0	0	0	0	139.26	0	0	0	139.26	43.71
	Huntley	0	0	0	0	0	0	0	152.97	0	0	0	152.97	68.10
	Milk River	0	0	0	0	0	0	0	102.24	0	0	0	102.24	55.34
	Sun River	0	0	0	0	0	0	0	68.45	0	0	0	68.45	31.12
Montana-North Dakota	Lower Yellowstone	0	0	0	0	0	0	0	109.20	0	0	0	109.20	63.72
Nebraska-Wyoming	North Platte	0	0	0	0	0	0	0	142.91	0	0	0	142.91	81.02
Nevada	Newlands	282.28	105.00	0	0	0	235.42	257.54	0	0	0	165.91	165.91	42.37
New Mexico	Carlsbad	0	0	0	0	0	25.00	25.00	0	110.08	27.92	0	69.00	99.95
	Tucumcari	0	0	0	0	0	0	0	0	187.50	26.83	0	107.17	85.52
New Mexico-Texas	Rio Grande	214.41	82.18	0	0	252.71	61.80	65.22	35.00	261.48	50.20	1,110.62	155.99	256.77
Oklahoma	Altus	0	0	0	0	0	0	0	0	129.68	45.72	0	87.70	130.72
Oregon	Deschutes (north unit)	0	0	0	0	300.00	0	300.00	0	0	0	0	0	27.81
	Umatilla	107.64	44.00	25.60	0	133.32	0	116.92	0	0	0	840.00	840.00	42.57
	Vale	39.10	0	20.00	0	174.00	0	68.31	170.49	0	0	565.00	174.59	76.15
Oregon-California	Klamath	0	0	0	0	0	0	0	105.54	0	0	0	105.54	163.27
Oregon-Idaho	Owyhee	40.48	0	68.15	0	116.13	100.54	125.00	191.96	0	0	280.00	192.10	93.29
South Dakota	Belle Fourche	0	0	0	0	0	0	55.56	115.23	0	0	0	115.23	39.03
Utah	Strawberry Valley	163.43	401.80	139.47	0	1,149.43	86.46	214.85	128.48	0	0	0	128.48	64.54
Washington	Okanogan	265.56	1,146.00	148.00	0	980.13	0	1,121.11	0	0	0	0	0	707.67
	Yakima	319.91	688.62	454.12	0	524.51	203.14	703.28	216.32	0	0	788.76	615.24	229.22
Wyoming	Kendrick	0	0	0	0	0	0	0	0	0	0	0	0	17.88
	Riverton	0	0	0	0	0	0	0	115.12	0	0	0	115.12	57.23
	Shoshone	0	0	0	0	0	0	138.60	105.07	0	0	0	105.07	62.49

SUPPLEMENTAL STORAGE PROJECTS

Colorado	Fruitgrowers Dam	$223.06	$36.24	$142.21	0	$120.27	0	$188.55	$178.29	0	0	0	$178.29	$98.29
	Pine River	0	0	0	0	0	0	.26	0	0	0	0	0	21.03
Idaho	Minidoka (Fremont-Madison irrigation district).	0	0	0	0	0	0	0	113.19	0	0	0	113.19	68.23
Nevada	Humboldt	0	0	0	0	0	0	0	0	0	0	0	0	60.21
	Truckee River Storage [2]	------	------	------	------	------	------	------	------	------	------	------	------	------
Oregon	Baker	0	0	0	0	0	0	0	0	0	0	0	0	30.96
	Burnt River	325.00	0	0	0	273.33	0	325.00	0	0	0	0	0	34.85
	Deschutes (central Oregon irrigation district)	0	0	0	0	51.39	760.86	519.91	0	0	0	0	0	100.73
	Stanfield	0	0	0	0	0	0	0	0	0	0	526.50	526.50	45.02
	Westland	0	0	0	0	0	0	0	0	0	0	146.32	146.32	40.22
Utah	Hyrum	100.00	0	0	0	300.00	0	181.60	122.24	0	0	360.00	123.84	56.84
	Moon Lake	0	0	0	0	109.75	0	74.63	0	0	0	0	0	16.05
	Ogden River	186.07	171.29	277.21	0	230.32	79.87	154.74	165.83	0	0	0	165.83	91.37
	Provo River (Deer Creek division)	421.16	338.57	180.96	0	799.22	0	520.55	153.24	0	0	0	153.24	135.04
	Sanpete	0	0	0	0	0	0	0	0	0	0	0	0	26.50
	Weber River	1,125.00	633.50	558.00	0	691.39	700.00	872.59	167.49	0	0	0	167.49	143.01

WATER CONSERVATION AND UTILIZATION PROJECTS

Idaho	Rathdrum Prairie (Post Falls unit)	0	0	0	0	$62.00	0	$278.36	0	0	0	0	0	31.74
Montana	Buffalo Rapids	0	0	0	0	0	0	0	$96.61	0	0	0	$96.61	41.94
	Intake	0	0	0	0	0	0	0	126.06	0	0	0	126.06	38.41
Nebraska	Mirage Flats	0	0	0	0	0	0	0	0	0	0	0	0	60.67
North Dakota	Buford-Trenton	0	0	0	0	0	0	0	109.04	0	0	0	109.04	30.70
Utah	Newton	0	0	0	0	0	0	0	115.66	0	0	0	115.66	61.20
	Scofield	$319.20	$233.33	$254.57	0	0	0	250.08	98.78	0	0	0	98.78	45.18
	Weighted averages	381.63	643.86	349.89	$345.52	572.05	154.17	518.14	146.99	$247.04	$47.77	$645.27	158.92	111.13

$530,623,945. This amounted to an average gross value of $120.69 per acre in cultivation. Production of food and forage crops in 1946 totaled 14,439,131 tons, which was another high record and due, in part, to outstanding yields realized in the 1946 harvest throughout the Nation.

Of the total acreage reported in cultivation (4,396,581 acres), 52 percent, or 2,291,178 acres, were receiving supplemental water, or a more stabilized water supply, due to the construction program of the Bureau of Reclamation.

A total of 54 projects was furnished irrigation water in 1946, with a total irrigable area of 5,150,831 acres. Included were eight new projects and a new diversion of another project where initial irrigation service was given. A total of 31,243 acres were reported as irrigated in these areas. Reports indicate that approximately 153,000 acres, the majority of which are in private ownership, may receive either a full or partial irrigation water supply during 1947 for the first time through works constructed by the Bureau of Reclamation.

Amendatory and New Repayment Contracts

The emphasis on providing settlement opportunities for veterans added impetus to those already fast-moving construction programs on those projects of the Bureau which had sufficient funds during fiscal year 1947. This pressure in turn was reflected in the repayment contract program for the year.

Of paramount significance was the development, approval, and execution of a form of repayment contract utilizing the combined authority of sections 9 (d) and 9 (e) of the Reclamation Project Act of 1939. Under this parallel plan, the cost of the distribution system is contracted for repayment under section 9 (d) and water service is provided under section 9 (e), both in the same contract.

The program of contract adjustments was given special emphasis during the year in an attempt to identify and correct financial problems on operating projects. Many of these adjustments are necessary because of extensive rehabilitation needed as a result of deferment of essential maintenance throughout the war years. In other cases on projects under construction, the costs have risen to a point where present repayment contract obligations will have to be exceeded to complete the project. In these cases negotiations are being conducted with the potential water users to assume these increased costs.

To facilitate commencement of construction work, a policy determination was made during the year whereby construction of storage works may be started upon appropriate assurances, such as a resolution of the water users' organization, signifying willingness to repay the construction costs, but no construction work is to be commenced on distribution systems until repayment contracts are executed.

The Congress, in the passage of authorizing legislation, emphasized that irrigation repayment should be based on the ability-to-pay concept and recognized the value and soundness of the Bureau's multipurpose projects in the West by specifically authorizing in several cases that payment of reimbursable costs allocated to irrigation could be made beyond the 40-year period established by basic Reclamation law, as follows:

Paonio project, Colorado	68-year repayment period.
Mancos project, Colorado	60-year repayment period.
Wellton-Mohawk unit of Gila project, Arizona	60-year repayment period.
Lewiston Orchards project, Idaho	50-year repayment period.

The Missouri Basin project repayment negotiations got under way with the execution of a combination water service and repayment contract by the Board of Directors of the Frenchman-Cambridge irrigation district on May 29, 1947. Construction has begun on Enders Dam on Frenchman Creek, which is the major water supply structure to serve the Frenchman-Cambridge unit in Nebraska. This contract has set the general pattern for other contracts being negotiated on the Missouri Basin project.

A report on the allocation of costs, financial feasibility, and probable repayment of the Central Valley project was presented to the President and to the Congress during the fiscal year. Allocations were made to navigation, flood control, irrigation, municipal and industrial water, and power. The total reimbursable cost is estimated as $334,787,000 and the nonreimbursable cost is $49,527,000 (cost estimates as of January 31, 1946).

Substantial progress was made during the year in resolving the cost allocation and repayment contract problems of the Coachella Valley division, All-American Canal System, California, which includes the Coachella Main Canal and a distribution system with appurtenant flood protective works for the Coachella Valley. Agreement was reached between the Coachella Valley County water district and the United States as to the most feasible plan of construction and as to the repayment ability of the water users. Legislation was passed on June 26, 1947, authorizing the Secretary of the Interior to make an allocation of costs under the Reclamation Project Act of 1939. An allocation report was made by the Commissioner, approved by the Secretary, and presented to the President and to the Congress. The form of repayment contract for the distribution system in the amount of $13,500,000 was agreed to by the Coachella board of directors.

Rehabilitation of Operating Irrigation Projects

A detailed field survey was undertaken during the fiscal year on all operating Federal Reclamation projects completed and placed in operation prior to January 1, 1942, to determine the extent of rehabilitation needed. During the war the scarcity of labor, materials, and supplies made it almost impossible for the water users to maintain their irrigation and drainage systems in first-class operating condition. Preliminary reports indicate that on some of the older projects, the operating works are becoming so worn out and obsolete that extensive rehabilitation may be necessary.

Canal Lining Program

In addition to the work performed in the Bureau laboratories in Denver, sections of experimental linings were placed in canals, laterals, and farm ditches on some of the projects for trial under actual field conditions. Some sections were included in new projects as a part of the construction; others were placed on operating projects in canals and laterals that had been in operation for some time. Measurements of seepage from canals and laterals and an analysis of the adequacy of, and need for, development and standardization of water measuring devices, begun during the fiscal year, are related closely to the canal-lining program. An interim report covering the progress and results of the program will be published early in calendar year 1948.

Sprinkler Irrigation

An analysis was made during the fiscal year of the use of pipe distribution irrigation systems. Pipe distribution systems may eliminate large transmission losses and reduce leveling costs on rolling lands. Sprinkler systems may reduce the amount of land leveling required, permit irrigation of steeper slopes without danger of erosion by the irrigation water, and induce economy in the use of water where climate and soil conditions are favorable.

Acreage Limitation

The 1946 comprehensive survey of landownership on Reclamation projects showed that on projects now authorized and under construction landowners will have to dispose of considerable acreages in excess of limitations under Reclamation law.

The Commissioner of Reclamation has initiated, through the regional directors and with the cooperation of irrigation districts, a program to assure the compliance with acreage limitations by owners now receiving project water for acreages in excess of that permitted under law.

A bill (S. 912) was introduced in the first session of the Eightieth Congress to exempt from the acreage restrictions in Reclamation law the lands to be served by the Central Valley project in California, the Valley Gravity Canal project in Texas, and the San Luis Valley project in Colorado.

Increased Costs of Bureau Projects

An analysis was made during the year of the extent and reasons for the increased estimate of the ultimate cost of Bureau projects on which major construction was programmed. The analysis included 22 regular Bureau projects, 13 water conservation and utilization projects, and 27 of the group A authorized units of the Missouri River Basin project.

The estimated cost of completion at 1945 prices totaled $2,165,000,000, an over-all increase of 56 percent over the original estimated costs. Of the $775,000,000 increase, 55 percent was attributed to increases in the price of labor and materials and 45 percent to changes in the original concept, design, specifications and features of the projects. Only about 25 percent of the estimated cost of completion had been expended as of June 30, 1945. The greatest portion of the increase, therefore, is an increase in estimates of costs to be expended.

Approximately $173,000,000 was expended on the construction of these projects during World War II, of which about $35,370,000 is ascribed to special exigencies arising out of war conditions and increased costs of labor and materials during the war. About one-third of the $35,370,000 can be traced directly to war conditions.

Federal Individual Income Tax Revenue

Preliminary estimates, based on secondary data, were made during the fiscal year of the Federal individual income taxes paid from the environs of selected Federal Reclamation projects. These preliminary estimates indicate that thus far the Federal income tax revenues exceed the Federal expenditures for irrigation development. For example, in the Yakima-Tieton irrigation district of the Yakima project, Washington, the Federal income taxes paid through 1946 as a direct result of the construction of this project are estimated at approximately $13,132,000, which compares with the construction cost of $3,584,027.

PROGRAMS AND FINANCE

Further streamlining of the administrative structure of the Bureau of Reclamation to consolidate budgeting, programming, and financing activities in one office was effectuated at the end of the fiscal year with establishment of the Office of Programs and Finance.

To form the new office, the Office of Progress Control, Office of Finance, and some functions of the Office of the Engineering Assistant were consolidated.

At the same time the Office of the Comptroller, to advise on financial matters and supervise audits, was created.

The action is the preliminary step in carrying out the desire of the Congress expressed in the Senate Appropriations Committee report on the 1948 Appropriation Act that the Department of the Interior improve the controls for holding allocations within appropriations to the activities fully sanctioned by the Congress.

Three main objectives were conceived at the time of the reorganization. The first was establishment of a uniform, correlated system for preparation of budgets and the annual and long-term programs. The second was the perfection of the accounting system and the expansion of a comprehensive audit system. The third, development of an integrated reporting system to provide a direct, controlled flow of information from the lowest operational level through to the Commissioner of Reclamation, and thence to the Secretary of the Interior, the Congress, and the public.

Procedures to attain these objectives were in an early stage of development as the year closed.

Accretions to Reclamation fund by States

States	Sale of public lands		Proceeds from Oil Leasing Act		Total to June 30, 1947
	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947	
Alabama			$21.00	$198,316.02	$198,316.02
Arizona		$2,777,582.75	7,188.30	19,316.46	2.796,899.21
Arkansas			84.00	970.47	970.47
California		8,334,200.72	2,179,056.17	28,705,664.40	37,039,865.12
Colorado		10,334,498.83	855,974.27	2,620,439.56	12,954,938.39
Florida				10.50	10.50
Idaho		7,063,989.01	25,537.25	48,767.40	7,112,756.41
Kansas		1,034,567.12	8,449.09	64,990.58	1,099,557.70
Louisiana			10,618.76	373,675.19	373,675.19
Michigan			621.60	4,914.06	4,914.06
Mississippi			357.11	703.08	703.08
Montana		15,397,913.87	376,870.34	3,008,653.72	18,406,567.59
Nebraska		2,099,807.84	36.75	483.00	2,100,290.84
Nevada		1,044,523.36	10,980.89	40,474.16	1,084,997.52
New Mexico		6,760,462.76	1,077,634.43	7,745,947.13	14,506,409.89
North Dakota		12,220,117.13	11,637.14	331,253.45	12,551,370.58
Oklahoma		5,932,027.90	4,670.91	20,969.21	5,952,997.11
Oregon		11,998,158.97	416.46	3,787.03	12,001,946.00
South Dakota		7,734,601.03	2,856.96	36,102.51	7,770,703.54
Utah		4,400,914.92	269,719.04	1,907,078.68	6,307,993.60
Washington		7,481,006.83	1,675.60	49,632.55	7,530,639.38
Wyoming		8,737,917.22	2,479,293.97	48,935,051.29	57,672,968.51
Total		113,352,290.26	7,323,700.04	94,117,200.45	207,469,490.71
Proceeds, Federal water power licenses					[1] 1,064,031.06
Proceeds, potassium royalties and rentals					[2] 3,052,586.03
Receipts from Naval petroleum reserves, 1920–38, act of May 9, 1938					29,778,300.23
Proceeds from right-of-way over withdrawn lands, act of July 19, 1919					[3] 3,223.23
Grand total					241,367,631.26

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[1] Proceeds for fiscal year $32,273.46.

[2] Proceeds for fiscal year, $529,713.79.

[3] Proceeds for fiscal year, $1,500.59.

Consolidated statement by projects of construction cost of irrigation and power works, other items reimbursable with construction, and deduction

State and project	Construction costs		Operation and maintenance before public notice (net)		Operation and maintenance deficits, arrearages and penalties		Construction revenues, contributed funds, and nonreimbursable appropriations (contra)		Abandoned works, nonreimbursable cost, and authorized charge-offs	Net balance	
	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947		Fiscal year 1947	To June 30, 1947
Arizona:											
Gila	$1,234,692.48	$9,799,612.11	[1] $25,163.82	[1] $57,575.06			[1] $480,027.90	[1] $791,315.20		$1,689,556.56	$10,533,352.25
Salt River		20,244,688.48		115,993.50		$866,573.92		3,200,814.81	$382,097.31		17,644,343.78
Yuma auxiliary		902,060.50				590.36	518.32	2,769.32		[1] 518.32	899,881.54
Arizona-California: Yuma		9,373,406.10		388,934.62		210,434.05	14,846.05	316,344.11		[1] 14,846.05	9,656,430.66
California:											
Central Valley	15,834,247.81	179,020,314.81	120,777.51	161,146.29			17,630.00	382,843.13		15,937,395.32	178,798,617.97
Orland		2,448,669.71		[1] 11,432.99	[1] $594.99	62,039.64		28,414.77		[1] 594.99	2,470,861.59
Colorado:											
Colorado-Big Thompson	7,756,781.73	34,144,532.56					47,689.83	1,159,791.84		7,709,091.90	32,984,740.72
Fruitgrowers Reservoir		200,740.71						2,500.00			198,240.71
Grand Valley		5,095,621.98		138,621.28		4,529.40	[1] 378.58	275,558.60	812,374.64	378, 58	4,150,839.42
Paonia	1,421.00	58,102.30								1,421.00	58,102.30
Pine River	20,003.84	3,349,536.12		1,695.72		2,519.44	[1] 50.00	2,269.77		20,053.84	3,351,481.51
San Luis Valley	226,997.15	537,312.60								226,997.15	537,312.60
Uncompaghre		8,976,443.18		311,103.02		196,368.80		25,601.42	1,261,956.28		8,196,357.30
Idaho:											
Boise	659,127.46	16,694,874.81		422,283.48		903,699.42	54,400.24	1,403,051.77	82,393.84	604,727.22	16,535,412.10
Boise-Anderson Ranch	3,840,582.24	19,451,798.34	[1] 6,301.29	[1] 6,301.29			4,648.53	18,646.90		3,829,632.42	19,426,850.15
Boise-Payette	3,027,246.41	7,957,748.61	12,319.52	23,909.29			2,232.66	5,847.19		3,037,333.27	7,975,810.71
King Hill		1,905,918.80				110,122.51		28,187.27	1,987,854.04		
Minidoka	334,431.32	23,052,430.56	356.15	316,075.74		644,440.26	807.87	2,208,677.78	2,288.15	333,397.60	21,801,980.63
Palisades	569,632.87	786,686.71					8,255.07	8,255.07		561,377.80	778,431.64
Kansas: Garden city		342,963.68		52,868.10				61,356.82	334,474.96		
Montana:											
Bitterroot		947,641.05				516,637.95					1,464,279.00
Frenchtown		273,603.11		5,496.26							279,099.37
Hungry Horse	1,612,977.11	1,774,548.77					82.50	82.50		1,612,894.61	1,774,466.27
Huntley		1,559,590.46		[1] 1,000.16		391,067.46	1,283.64	36,725.22	62,049.83	[1] 1,283.64	1,850,882.71
Milk River	[1] 22,463.43	8,650,943.45	256,76	436,762.58		101,062.03	39.38	124,301.34	1,735,969.31	[1] 22,246.05	7,328,497.41
Sun River	39,843.97	9,791,353.32		133,102.38		103,137.65		48,555.64	89,650.57	39,843.97	9,889,387.14
Montana-North Dakota: Lower Yellowstone		3,685,433.14	[1] 400.00	[1] 2,097.42		922,893.29	843.00	131,562.25	412,198.49	[1] 31,187.49	4,062,468.27
Nebraska-Wyoming: North Platte	12,985.57	19,564,133.84		743,294.42		1,516,486.08	65,024.48	916,418.32		[1] 52,038.91	20,907,496.02
Nevada:											
Humboldt		1,293,741.14		21,020.51			25.00	123,797.73		[1] 25.00	1,190,963.92
Newlands		7,947,282.86		[1] 2,155.44		44,976.32		52,347.53	4,437,820.00		3,499,936.21
Truckee storage		1,093,328.31		9.926.48				22.048.30			1,081,206.49

New Mexico:											
Carlsbad	2,638.18	3,992,734.62		[1] 17,751.77		93,395.50	531.19	30,625.41	374,883.58	2,106.99	3,662,869.36
Hondo		339,491.68		32,952.01				656.03	371,787.66		
Tucumcari	1,905,012.19	11,209,482.54	60,017.19	74,422.44			3,036.48	3,036.48		1,961,992.90	11,280,868.50
New Mexico-Texas: Rio Grande	363,656.63	21,196,993.24		15,771.13		364,531.65	217,763.97	4,951,912.09	357,841.20	145,892.66	16,267,542.73
North Dakota:											
Buford-Trenton		223,423.06		[1] 31.75				1,967.62	221,423.69		
Williston		517,630.09		[1] 165.00				108,370.40	409,094.69		
Oklahoma: W. C. Austin [2]	1,939,254.64	8,566,476.33	[1] 1,914.80	[1] 1,914.80			4,500.00	1,141,250.00		1,932,839.84	7,423,311.53
Oregon:											
Baker		281,591.64						5,003.00			276,588.64
Burnt River		601,025.82						1,290.82			599,735.00
Deschutes	1,545,428.21	7,018,360.97	34,861.05	37,155.18			782.31	782.31		1,579,506.95	7,054,733.84
Umatilla	2,463.57	5,240,291.63				230,117.15	4,281.50	111,301.57	888,340.82	[1] 1,817.93	4,470,766.39
Vale	[1] 65.00	4,858,906.22		39,773.56		3,027.24	729.60	24,172.29		[1] 794.60	4,877,534.73
Oregon-California: Klamath	652,241.56	8,532,853.60	[1] 180.00	100,546.12		85,433.09	439,592.75	2,565,374.92	10,895.22	209,073.31	6,142,562.67
Oregon-Idaho: Owyhee	105,762.70	18,294,042.16			1,847.07	260,923.59	3,614.86	24,227.34		103,994.91	18,530,738.86
South Dakota: Belle Fourche		4,630,391.88		[1] 1,989.03		676,577.53		29,042.05	379,031.58		4,896,906.75
Texas: Valley gravity canal and storage	408,870.85	930,738.26					528.85	528.85		408,342.00	930,209.41
Utah:											
Hyrum		941,884.54						11,884.54			930,000.00
Moon Lake		1,600,360.94						8,093.18			1,592,267.76
Ogden River	24,142.48	4,403,938.21		2,361.87				12,886.97		24,142.48	4,393,413.11
Provo River	2,025,638.47	13,211,279.28	[1] 30,539.21	[1] 46,608.54			11,095.62	43,638.79		1,984,003.64	13,121,031.95
Salt Lake Basin		2,725,885.40				5,897.20	30.00	46,415.77		30.00	2,685,366.83
Sanpete		374,540.34						1,284.40			373,255.94
Strawberry Valley		3,507,423.49		10,744.06		89,635.49		258,379.12			3,349,423.92
Washington:											
Okanogan		1,452,129.45		[1] 47,766.87		26,882.64		7,496.28	997,861.70		425,887.24
Yakima		26,346,976.81	122,898.42	144,870.09	33.09	150,199.83	50,108.03	835,950.45	4,214.60	72,823.48	25,801,881.68
Yakima-Roza	1,338,075.36	13,130,083.79	[1] 12,819.01	31,430.20				1,735.40		1,325,256.35	13,159,778.59
Wyoming:											
Kendrick	110,208.11	18,248,970.68	30,277.16	154,524.43			478,490.32	2,223,117.95		[1] 338,005.05	16,180,377.16
Riverton	563,862.35	7,009,833.58			[1] 10,484.67	91,480.37	1,211.60	33,139.11		552,166.08	7,068,174.84
Shoshone	711,680.94	15,639,002.92	8,579.30	66,373.12		467,235.44	164,984.44	1,650,600.30	1,545,129.47	555,275.80	12,976,901.71
Shoshone-Heart Mountain [3]											
Total	46,847,378.77	605,951,825.74	313,024.93	3,796,367.76	[1] 9,199.50	9,142,915.30	1,119,151.61	23,929,617.64	17,161,631.63	45,998,712.60	577,799,859.53

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[1] Contra.

[2] Formerly the Altus project.

[3] Shoshone-Heart Mountain combined with Shoshone in this report.

WATER CONSERVATION AND UTILITY PROJECTS

State and project	Construction costs		Operation and maintenance during construction		Construction revenues (contra)		Net construction costs	
	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947
Colorado: Mancos	$96, 921. 88	$845, 247. 38					$96, 921. 88	$845, 247. 38
Idaho:								
Mann Creek		32, 836. 75				$267. 47		32, 569. 28
Rathdrum Prairie	14, 388. 53	363, 702. 31	$1, 046. 19	$1, 938. 50		5. 00	15, 434. 72	365, 635. 81
Montana:								
Bitterroot	2, 022. 33	88, 603. 16					2, 022. 33	88, 603. 16
Buffalo Rapids, first division	50. 17	2, 004, 412. 11		39, 695. 81		665. 07	50. 71	2, 043, 442. 85
Buffalo Rapids, second division	292, 918. 12	1, 733, 012. 17	36, 286. 82	68, 215. 76			329, 204. 94	1, 801, 227. 93
Intake	15, 108. 98	83, 275. 76	591. 05	1, 841. 39			15, 700. 03	85, 117. 15
Milk River, Dodson	56, 441. 86	102, 206. 84					56, 441. 86	102, 206. 84
Missoula Valley	94, 809. 81	209, 607. 66					94, 809. 81	209, 607. 66
Saco Divide		2, 477. 97						2, 477. 97
Nebraska: Mirage Flats	259, 743. 83	2, 828, 995. 43	[1] 1, 399. 54	[1] 4, 339. 54		495. 00	258, 404. 29	2, 824, 160. 89
North Dakota: Buford-Trenton		945, 858. 84						945, 858. 84
South Dakota:								
Angostura		43, 484. 62						43, 484. 62
Rapid Valley	92, 531. 66	854, 225. 51			$164. 72	1, 867. 16	92, 366. 94	852, 358. 35
Texas: Balmorhea	348, 274. 81	378, 095. 86			225. 39	225. 39	348, 049. 42	377, 870. 47
Utah:								
Newton	12, 185. 84	546, 393. 12					12, 185. 84	546, 393. 12
Scofield	66, 524. 38	872, 695. 94	1, 780. 11	1, 780. 11			68, 304. 49	874, 476. 05
Wyoming: Eden	12, 859. 44	404, 963. 85					12, 859. 44	404, 963. 85
Total	1, 364, 782. 18	12, 340, 095. 29	38, 364. 63	109, 132. 03	390, 11	3, 525. 09	1, 402, 756. 70	12, 445, 702. 23

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[1] Contra.

SPECIAL PROJECT

	Construction costs		Contributions		Net balance	
	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947	Fiscal year 1947	To June 30, 1947
Colorado River Dam fund:						
All-American Canal	$4,537,326.25	$40,731,130.78		$20,000.00	$4,537,326.25	$40,711,130.78
Boulder Canyon	1,935,124.44	146,093,822.12	[1] $70,149.97		2,005,274.41	146,093,822.12
Arizona:						
Davis Dam	10,052,680.63	15,959,801.44			10,052,680.63	15,959,801.44
Parker Dam	14,466.22	6,836,319.32	14,466.22	6,836,319.32		
Parker Power	[1] 20,151.51	15,500,493.83			[1] 20,151.51	15,500,493.83
Montana: Fort Peck	151,548.20	962,155.83			151,548.20	962,155.83
Texas: Colorado River	35,431.48	23,904,614.65		9,580.75	35,431.48	23,895,033.90
Washington: Columbia Basin	19,771,481.07	209,466,276.93	[1] 1,947,241.35	3,234,416.88	21,718,722.42	206,231,860.05
Missouri Basin projects	5,653,854.19	5,860,179.07			5,653,854.19	5,860,179.07
Total	42,131,760.97	465,314,793.97	[1] 2,002,925.10	10,100,316.95	44,134,686.07	455,214,477.02
Grand total	90,343,921.92	1,083,606,715.00				

[1] Contra.

NOTE: Construction cost includes work in place only and does not include expenditures made for materials, supplies, and equipment carried in inventories at the end of the fiscal year and other undistributed items which will eventually be charged to construction cost.

INVESTIGATIONS AND PLANNING

Planning activities were continued at an accelerated rate during the fiscal year in the 17 Western States. Comprehensive water resource development surveys of 23 river basins and some 160 investigations of subbasins and projects were in progress during the year. In addition, activities relating to the reconstruction, rehabilitation, extension, and the financial adjustment of existing projects were carried on to a lesser extent.

Regular appropriations and carry-over funds from the preceding fiscal year were available in amounts sufficient to make it possible to expand and accelerate the comprehensive reclamation planning throughout the West as had been directed by the Congress. Funds available included an appropriation of $5,000,000 and a carry-over of $1,381,000 for general investigations, and an appropriation of $500,000 and a carry-over of $1,197,000 for Colorado River development. The total available appropriations and carry-over amounted to $8,078,000, and the total expenditures during the fiscal year amounted to $7,103,477. At the close of the fiscal year, $388,519 was available as carry-over from the Colorado River development fund, and $586,004 from the general investigation fund, or a total carry-over of $974,523.

Columbia River Basin

One of the most outstanding accomplishments during the fiscal year was the completion and transmittal to the affected States and the Secretary of War of a proposed report on a comprehensive plan for the development of the water resources of the Columbia River Basin, in which is proposed the immediate authorization of 11 projects and the reauthorization of 3 projects. The report lists 224 additional projects for possible development which would greatly expand irrigation and power development in the Columbia River Basin.

Colorado Basin Inventory

At the close of the year preparations were being made to submit the comprehensive inventory report of potential water resource development in the Colorado River Basin and comments thereon to the Congress as an interim report on the status of the investigations in the Colorado River Basin.

Other Reports

Three planning reports submitted to the Congress during the year included the report on the Paonia project, Colorado, which was printed as Senate Document 61, and was followed by reauthorization of the project for construction, Public Law 117, approved June 26, 1947; an unfavorable report on the Cody Dam and power plant, Wyoming; and a favorable report on the Fort Sumner project, New Mexico.

Preliminary drafts of the following additional reports were received in Washington and were in various stages of processing at the close of the fiscal year:

Bridge Canyon and Parker routes comparison, Arizona.
Balmorhea project, Texas.
Canton project, Texas.
Chino Valley project, Arizona.
Gooseberry project, Utah.
Hammond project, New Mexico.
Hassayampa project, Arizona.
Nueces River Basin, Texas.
Preston bench project, Idaho.
Rathdrum Prairie project-Hayden Lake unit, Idaho.
Robert Lee project, Texas.
Snowflake project, Arizona.
Valley Gravity project, Texas.
Virgin River subbasin, Utah, Arizona, Nevada.
Yakima project-Kennewick division, Washington.
Yolo-Solano development, California.

At the request of the Governor of the Territory of Hawaii, investigations were carried out during the year to determine the possibilities of developing irrigation on the Waimea Plain on the island of Hawaii.

Coordination of Planning

An informal steering committee was established during the year to assure continuing coordination and to provide appropriate participation by State officials on investigations pertaining to the development of the water resources of the Gunnison River Basin, including the possible diversion of water to the Arkansas River Basin.

As a result of conferences, Canadian officials gave assurance that they would cooperate in a joint reference with the United States concerning the water resources of the Belly and Waterton Rivers and other streams that are of common interest to the two countries from the Continental Divide on the west to and including the Red River on the east for submittal to the International Joint Commission.

Hydrology

A new section was established in the Division of Hydrology of the Branch of Project Planning to undertake sedimentation studies in connection with reclamation development, including the resurvey of existing reservoirs. Additional laboratory facilities have been provided in Denver to study sedimentation.

Planning Cut-Back

Anticipated reductions in appropriations necessitated immediate preparation of plans for a drastic cut-back in investigational activities. Accordingly, the following policies were established to guarantee the most effective use of the limited funds that were expected to be made available by the Congress for fiscal year 1948: (*a*) Completion of those investigations already in the advanced stage, (*b*) selection of a small number of investigations for continuation, and (*c*) stopping of other investigations in an orderly way so that the available information and other data could be preserved in effective form for use when the investigations are revived. The cut-back in planning activities has necessitated the laying off or reassignment of about half of the personnel working on investigations throughout the Bureau of Reclamation.

POWER DEVELOPMENT

The development of western power resources by the Bureau of Reclamation is becoming increasingly important. The use of power revenues to assist in repayment of irrigation costs, and the use of power for irrigation pumping advance basin-wide reclamation development. Given impetus by adequate sources of low-cost power, industrial and mining expansion opens new frontiers of wealth and broadens agricultural markets. Rural electrification extends the benefits of low-cost power to farming communities and rural areas for irrigation pumping and labor-saving devices. Bureau of Reclamation power projects supply part of the West's rapidly growing power needs without draining vital oil reserves.

Full utilization of the power resources cannot be realized until adequate power systems are built to bring power to the major load centers. An expanded power market spells more widespread use and adequate revenues. The significant fact of past power operations has been the fullest utilization of generating capacity permitted by water supply. Plants have frequently been operated continuously to meet the power demands and this situation will continue until adequate generating capacity can be attained by completion of power plants now under construction or authorized.

At the present time the Bureau of Reclamation is operating 16 power plants with a total installed name-plate capacity of 2,095,400 kilowatts. A reduction in installed capacity from last year results from the removal of two 75,000-kilowatt Shasta units temporarily installed at Grand Coulee Dam as a wartime expedient. A further reduction in capacity of 72,000 kilowatts at Grand Coulee Dam results from listing the name-plate rating of 108,000 kilowatts for the six main units instead of the actual load capability of 120,000 kilowatts each, as previously reported.

The Bureau of Reclamation has constructed nine power plants of 30,687-kilowatt capacity which are operated by others. A total of six power plants constructed and operated by others on Reclamation projects have an installed capacity of 62,400 kilowatts. The ultimate installed capacity of these plants will be 76,800 kilowatts.

The Fort Peck power plant which is operated by the Corps of Engineers and from which the power is marketed by the Bureau of Reclamation has a present installed capacity of 35,000 kilowatts and an ultimate capacity of 85,000 kilowatts.

The Bureau of Reclamation has 10 power plants under construction which will have a total installed capacity of 765,000 kilowatts. Additional projects which have been authorized total 16, having a total installed capacity of 753,700 kilowatts.

Power plants under construction and authorized for construction in the Missouri River basin by the Corps of Engineers for which the Bureau of Reclamation has been given the responsibility for marketing the power total 1,105,200 kilowatts in 6 plants. The individual plants are shown on the following tabulation.

At the close of the fiscal year, the Bureau of Reclamation had approximately 2,500 miles of high-voltage transmission lines in operation. These transmission lines carried power to 25 municipal utilities, 7 State government utilities, 32 cooperatives, 34 public authorities, 2 Federal utilities, 31 privately owned utilities, and a larger number of relatively smaller customers.

The total power sales for all 16 power plants for fiscal year 1947 reached 12,127,730,000 kilowatt-hours as compared to a total of 11,417,897,000 for fiscal year 1946. Revenues derived from power operations totaled $21,732,811 for fiscal year 1947, representing a substantial increase over sales of $20,716,398 for fiscal year 1946. The increase in generation and revenues were principally attributed to the increase in power consumption in the Pacific Northwest area. The resumption of activity in the aluminum industry and increased industrial activity resulted in maximum continuous operation of the huge Grand Coulee power plant. Reduced sales of power on the Boulder Canyon, Parker Dam, Central Valley, and Rio Grande projects were the result of low water conditions.

Future construction of power plants and transmission systems to provide integrated operation of the individual power plants will result in more favorable use of water and minimize the loss in power generation during periods of low run-off.

Hydroelectric plants on reclamation projects—operating, under construction, as authorized as of July 1947

CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Year of initial operation	Present name-plate capacity (kilowatts)	Ultimate name-plate capacity (kilowatts)	Present number of generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Arizona, Nevada	Boulder Canyon	Hoover[1]	1936	1,034,800	1,322,300	12–82,500; 1–40,000; 2–2,400	15–82,500; 2–40,000; 2–2,400.
California	Yuma	Siphon Drop	1926	1,600	1,600	2–800	2–800.
Arizona-California	Parker	Parker	1942	120,000	120,000	4–30,000	4–30,000.
California	Central Valley	Shasta	1944	154,000	379,000	2–75,000; 2–2,000	5–75,000; 2–2,000.
Colorado	Colorado-Big Thompson	Green Mountain	1943	21,600	21,600	2–10,800	2–10,800.
Idaho	Boise	Boise River	1912	1,500	1,500	3–500	3–500.
Do	do	Black Canyon	1925	8,000	8,000	2–4,000	2–4,000.
Do	Minidoka	Minidoka	1909	13,400	13,400	1–5,000; 1–2,400; 5–1,200	1–500; 1–2,400; 5–1,200.
Wyoming	North Platte	Guernsey	1927	4,800	4,800	2–2,400	2–2,400.
Do	do	Lingle	1919	1,400	1,400	2–400; 2–300	2–400; 2–300.
New Mexico	Rio Grande	Elephant Butte	1940	24,300	24,300	3–8,100	3–8,100.
Washington	Columbia Basin	Grand Coulee[2]	1941	668,000	1,974,000	6–108,000; 2–10,000;[3]	18–108,000; 3–10,000;[3]
Do	Yakima	Prosser	1932	2,400	2,400	1–2,400	1–2,400.
Wyoming	Kendrick	Seminoe	1939	32,400	32,400	3–10,800	3–10,800.
Do	Riverton	Pilot Butte	1925	1,600	1,600	2–800	2–800.
Do	Shoshone	Shoshone	1922	5,600	5,600	1–4,000; 2–800	1–4,000; 2–800.
Subtotal				2,095,400	3,913,900		

CONSTRUCTED BY BUREAU OF RECLAMATION; OPERATED BY OTHERS

State	Project	Name of plant	Year of initial operation	Present name-plate capacity (kilowatts)	Ultimate name-plate capacity (kilowatts)	Present number of generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Arizona	Salt River	Roosevelt	1909	15,400	15,400	5–1,080; 1–4,000; 1–6,000	5–1,080; 1–4,000; 1–6,000.
Do	do	Arizona Falls[4]	1913	850	850	2–425	2–425.
Do	do	Cross Cut[4]	1914	5,100	5,100	1–3,000; 3–700	1–3,000; 3–700.
Do	do	S. Consolidated[4]	1912	1,600	1,600	2–800	2–800.
Colorado	Grand Valley	Grand Valley	1932	3,000	3,000	2–1,500	2–1,500.
Nevada	Newlands	Lahontan	1911	1,500	1,500	3–500	3–500.
Oregon	Deschutes	Cove No. 2[5]	1946	1,500	1,500	1–1,500	1–1,500.
Utah	Strawberry Valley	Spanish Fork[6]	1908	1,550	1,550	2–450; 1–250; 1–400	2–450; 1–250; 1–400.
Washington	Yakima	Rocky Ford	1916	187	187	1–187	1–187.
Subtotal				30,687	30,687		

CONSTRUCTED AND OPERATED BY WATER USERS' ORGANIZATIONS							
Arizona	Salt River	Chandler[7]	1919	600	600	1-600	1-600.
Do	do	Horse Mesa[7]	1927	30,000	30,000	3-10,000	3-10,000.
Do	do	Mormon Flat[7]	1926	7,000	7,000	1-7,000	1-7,000.
Do	do	Stewart Mountain[7]	1930	10,400	10,400	1-10,400	1-10,400.
California	All American	Drop No. 3[8]	1941	4,800	9,600	1-4,800	2-4,800.
Do	do	Drop No. 4[8]	1941	9,600	19,200	1-9,600	2-9,600.
Subtotal				62,400	76,800		
CONSTRUCTED BY CORPS OF ENGINEERS, WAR DEPARTMENT; POWER MARKETED BY BUREAU OF RECLAMATION							
Montana	Fort Peck	Fort Peck	1943	35,000	85,000	1-35,000	2-35,000; 1-15,000.
UNDER CONSTRUCTION BY BUREAU OF RECLAMATION							
Arizona-Nevada	Davis	Davis	1949	0	225,000	0	5 45,000.
California	Central Valley	Keswick	1948	0	75,000	0	3-25,000.
Colorado	Colorado-Big Thompson	Estes	1949	0	45,000	0	3-15,000.
Do	do	Marys Lake	1949	0	8,100	0	1-8,100.
Idaho	Boise	Anderson Ranch	1949	0	[9] 40,500	0	3-13,500.
Do	Palisades	Palisades	1952	0	[10] 30,000	0	2-15,000.[10]
Montana	Hungry Horse	Hungry Horse	1953	0	286,000	0	4-71, 500.
Wyoming	Missouri Basin	Boysen	1951	0	15,000	0	2-7,500.
Do	do	Kortes	1949	0	36,000	0	3-12,000.
Do	Shoshone	Heart Mountain	1948	0	5,000	0	1-5,000.
Subtotal				0	765,600		
UNDER CONSTRUCTION BY CORPS OF ENGINEERS, WAR DEPARTMENT; POWER TO BE MARKETED BY BUREAU OF RECLAMATION							
North Dakota	Missouri Basin	Garrison	1953	0	320,000	0	5-64,000.
South Dakota	do	Fort Randall	1953	0	240,000	0	6-40,000.
Subtotal				0	560,000		

Hydroelectric plants on reclamation projects—Operating, under construction, as authorized as of July 1947—Continued

AUTHORIZED TO BE CONSTRUCTED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Year estimated complete	Present nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Present number of generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
California	Kings River	Balch [11]	1951	0	[11] 52,500	0	
Do	do	Haas	1951	0	45,000	0	
Do	do	Pine Flat	1951	0	45,000	0	3-15,000.
Do	do	Wishon	1951	0	4,000	0	
Colorado	Colorado-Big Thompson	Quillan	1952	0	28,500	0	3-9,500.
Do	do	Cottonwood	1952	0	11,500	0	2-5,750.
Do	do	Rattlesnake	1952	0	13,500	0	2-6,750.
Do	do	Flatiron Mountain	1952	0	41,000	0	3-6,500; 2-10,750.
Do	do	Big Thompson	1952	0	6,700	0	1-6,700.
Montana	Canyon Ferry Dam	Canyon Ferry	1953	0	36,000	0	3-12,000.
Do	Hardin	Yellowtail	after 1952	0	120,000	0	4-30,000.
North Dakota	Missouri Basin	Crosby [12]		0	70,000	0	4-17,500.
Do	do	Des Lacs [12]		0	70,000	0	4-17,500.
South Dakota	do	Miller [12]		0	180,000	0	4-45,000.
Washington	Yakima (Roza)	Yakima River		0	10,000	0	
Wyoming	Missouri Basin	Glendo		0	20,000	0	
Subtotal				0	753,700		

AUTHORIZED TO BE CONSTRUCTED BY CORPS OF ENGINEERS, WAR DEPARTMENT, POWER TO BE MARKETED BY BUREAU OF RECLAMATION

State	Project	Name of plant	Year estimated complete	Present nameplate capacity (kilowatts)	Ultimate nameplate capacity (kilowatts)	Present number of generators and capacities (kilowatts)	Ultimate number of generators and capacities (kilowatts)
Nebraska	Bostwick	Harlan		0	1,200	0	1-1,200.
South Dakota	Missouri Basin	Big Bend		0	120,000	0	6-20,000.
Nebraska-South Dakota	do	Gavins Point		0	24,000	0	3-8,000.
South Dakota	do	Oahe		0	400,000	0	8-50,000.
Subtotal				0	545,200		
Total (from this tabulation)				2,223,487	6,730,887		
Total (with Grand Coulee units figured at 120,000 kilowatts)				2,295,487	6,946,887		

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[1] Power plant units operated by power allottees under agency contract.

[2] Power marketed by Bonneville Power Administration.

[3] These units with a nameplate rating of 108,000 kilowatts have continuous operating capacity of 120,000 kilowatts.

[4] Power plant constructed by Bureau of Reclamation with Salt River Valley Water

[6] Three plants: (*a*) Spanish Fork (upper); (*b*) Spanish Fork (lower); (*c*) Payson.

[7] Constructed and operated by Salt River Valley Water Users' Association.

[8] Constructed and operated by Imperial irrigation district.

[9] 27,000 kilowatts presently authorized.

[10] Possibly increase to 50,000 kilowatts ultimately

ORGANIZATION

No basic changes were made in the Bureau's organization structure xcept in region 6 and the Commissioner's office. Efforts were priarily directed to streamlining the structure resulting from the 1943 eorganization of the Bureau which consolidated field activities into even regions and established the Commissioner's branches and offices n a staff basis. In region 6 the Missouri Basin project development taff was eliminated and its activities consolidated with other cenralized operations of the region. The staff supervisory functions of he region were segregated to facilitate the decentralization of operatng functions to project field offices.

In the Washington office the Offices of the Director of Finance and rogress Control were abolished and the Office of Programs and inance and the Office of the Comptroller established at the end of the iscal year.

Decentralization and Delegations

Emphasis was placed on further decentralization and delegations of uthority to push operating functions as close to the project level as ossible and to vest subordinate officials with the authority necessary o carry out these functions. An anticipated congressional limitation n personal-service expenditures by Reclamation offices in Denver orced the Bureau during the latter part of the year to lay plans for, and to devote a large amount of time and effort to, a rapid deentralization of the less complicated engineering and design funcions previously performed by the Branch of Design and Construction n Denver.

Project-Type Organization

In keeping with the decentralization program, emphasis was placed on building up competent project-type organizations primarily hrough the establishment of new, and improvement of existing, district organizations. Such organizations are providing the means for maintaining qualified staffs at the work site to perform the Bureau's work at the field level, to achieve effective cooperation with affected water and power users, and to facilitate the integrated river sub-basin and basin approach to development problems of the West. Progress was made in this direction in regions 1, 2, 3, 6, and 7.

Manual of Instructions

Work progressed rapidly on the Bureau's administrative manual which is designed to serve three purposes—enable the Commissioner and a small staff to give technical guidance and supervision over widespread activities, insure adherence to approved and uniform methods and standards, and aid in the training of new employees.

PERSONNEL

Further decentralization of authority to act in personnel matters was the principal target of the Bureau's personnel program during the year. The requirement for adequate staff guidance to field offices has increased with each step toward greater decentralization. Staff guidance was implemented by the publication of a substantial portion of the Bureau Personnel Handbook and rescission of a large volume of obsolete personnel instructions.

Total Bureau employment increased from 14,362 to 16,250 during the year ending June 30, 1947. World War II veterans comprised 6,794 of the Bureau staff on June 30. Employment operations throughout most of the year were directed toward the staffing of regional and project offices with sufficient technical and administrative personnel to carry out the responsibilities assigned the Bureau by the Congress.

During May and June, however, the limitations and reductions in the 1948 appropriation bill made it necessary to enter into reduction in force. Notices of separation were given 1,098 Bureau employees, but it was possible, fortunately, to reassign, approximately 500 to positions which were to continue after June 30. Many technical and professional employees resigned the service rather than accept reductions in grade, transfers, or the uncertainty of future employment with the Federal Government.

Civil Service Board

The Central Board of United States Civil Service Examiners was organized in Denver during the year. By June 30, 12,000 applications for examination had been processed by the Board, and approximately 6,500 names had been entered on eligible registers.

Training Program

The work-study plan, by which employees work full or part time and simultaneously receive and apply advanced theoretical instruction in fields related to their work, was participated in by over 600 employees (about 1 out of every 4) in the branches and offices located in Denver.

The field engineer's training program conducted by the Branch of 'esign and Construction enrolled 164 field employees for training in ›ncrete and earth control and design, earth dam design, and canal ork.

An engineer-trainee program was inaugurated following the ap- roval by the Civil Service Commission of a plan to appoint, in sub- rofessional grades, students who are in their last 2 years of the college ıgineering curriculum and who qualify through a written examina- on. Students participating in this program receive on-the-job train- ıg, generally during the summer months, in preparation for assign- ıent to professional engineering positions at the completion of their ›llege courses.

Additional on-the-job training was provided for eligible veterans. 'he powerhouse operator's training program gained impetus during he year, as did orientation, supervisory, and other practical training rograms.

OFFICE OF CHIEF COUNSEL

Legislation.—The following laws enacted during the first session of he Eightieth Congress are of importance to the Bureau of Reclama- ion: Public Law 43 (H. J. Res. 140) changing the name of Boulder)am to Hoover Dam; Public Law 69 (S. 214) changing the name of he Lugert-Altus project to the W. C. Austin project; Public Law 73 H. R. 804) authorizing the reduction of certain accrued interest harges payable by the farmers' irrigation district, North Platte proj- ct; Public Law 109 (H. R. 3197) authorizing the Secretary of the nterior to enter into an amendatory contract with the Mancos Water 'onservancy District, Colorado; Public Law 117 (H. R. 3143) author- zing the construction of the Paonia reclamation project, Colorado; 'ublic Law 121 (H. R. 3348) to declare the policy of the United States vith respect to the allocation of costs of construction of the Coachella livision of the All-American Canal; Public Law 217 (H. R. 2167) uthorizing the inclusion within the Angostura unit of the Missouri Basin project of certain lands acquired by the United States under 'arious emergency relief acts; Public Law 272 (S. 483) providing for he reduction in acreage of the authorized Gila project, Arizona, reau- horizing a portion of that project and authorizing another portion.

Chief among bills which failed of passage, but which, if enacted would have made basic changes in the Reclamation laws were the so-called Rockwell (H. R. 1886) and Lemke (H. R. 1977) bills stemming from the long-standing controversy concerning the application of the interest component on power as an aid to irrigation. The Rockwell bill, the most important effect of which would have been to increase Reclamation power rates, had additional features which were also highly objectionable to the Bureau. The Lemke bill (H. R. 1977) was in accord with the Bureau's views. After many hearings, the bill finally reported out (H. R. 2873) by the House Public Lands Committee, proposes certain changes in the Reclamation law, some of which would be beneficial. Interest to be paid on the power investment would be reduced from 3 to 2½ percent. The Secretary would be authorized to make nonreimbursable allocations of costs of proposed projects to recreation, general salinity control and silt control. Existing projects would be reexamined and appropriate portions of their costs could be allocated to those purposes and also to fish and wildlife conservation. On the other hand, the period for amortization of the power investment would be fixed at 78 years and not more than one-fifth of the revenues derived from the interest component of power rates could be applied in aid of irrigation.

Another measure of great importance to fundamental Bureau policy was Senate bill 912, principally sponsored by Senator Downey, the purpose of which was to repeal the so-called excess land provisions of the Reclamation laws in the Central Valley of California and incidentally to effect the same result in the San Luis and Valley Gravity projects.

Litigation

Extensive pending and potential water-right litigation is under way in water districts Nos. 36 and 51 in the State of Colorado affecting the Colorado-Big Thompson project. On June 10, the Commissioner appointed by the Court of Claims to hear the evidence in *Cotton Land Co.* v. *U. S.* reported that the flooding and isolation of the plaintiff's land, because of which the suit was brought, resulted from the formation of a delta in the Colorado River and that this delta was caused by the construction, maintenance, and operation of Parker Dam. The decision of the court has not yet been announced. Several suits (*California Zinc Co., et al.* v. *U. S.*, in the Court of Claims; *U. S* v. *Shasta Iron Co.*, California District Court) involve claims due to the impounding of waters in Shasta Reservoir. By virtue of condemnation action the last parcel of land in private ownership needed for the Davis Dam Reservoir will be acquired. This sets a record perhaps, in speed of acquisition of land prior to water storage.

A memorandum decision was rendered by the United States District Court at St. Paul in the case of *Northern Pacific Railway Co.* v. *U. S* The issue was that of freight charges for shipments of cement to the Columbia Basin project. Action was initiated in 1939 and involved question of whether a special contract rate which was lower than ommercial tariffs expired on March 21, 1938, or continued throughout he period of construction of the Grand Coulee Dam and power plant. The court held in favor of the United States on the main point, finding hat the special contract rate did not expire in 1938 but continued in effect. The court, however, held against the United States with respect to various counter claims which had been raised. It is estimated hat the holding in favor of the Government on the principal point nvolved denies to the plaintiffs potential claims to the extent of approximately $2,500,000.

Considerable litigation is arising out of overcharges by railroads for ransportation of construction material. Cement seems to be an item heavily so favored. Thus, the California Railroad Commission is now considering claims for overcharges for the transportation of cement for the construction of Shasta Dam. It is very important that t be clearly established that any recovery deposited in the Treasury shall be so credited as to reduce the cost of the Central Valley project to the water and power users.

This whole general question of freight rates charged on Bureau shipments is being investigated by the Department of Justice. After numerous conferences between Chief Counsel and the Attorney General's Office, a formal request was made to the Attorney General to take appropriate action to recover excess charges made on past shipments and to establish more favorable rates for future shipments.

The Court of Claims had decided in favor of the Government in a suit brought by the city of Los Angeles to obtain a refund of advances in the sum of $55,000 made by it in 1922 for preliminary investigations on the Colorado River.

A declaratory judgment action has been filed in the United States District Court for the Western District of Oklahoma to determine the rights of the United States under an Oklahoma statute granting a free right-of-way for canal purposes to the United States across State lands. In this case, the State conveyed State lands without an express reservation in the deed of the right-of-way to the United States, in contravention of the provisions of the Oklahoma statute requiring that such a reservation be contained in the conveyance.

General.—Legal research, advice and draftsmanship in connection with all phases of Reclamation—investigations, surveys, authorizations, administration, designing, construction, and operation and maintenance—has been carried on in the Chief Counsel's office. The work range included practically the entire field of Reclamation activity.

REGIONAL PROGRAMS

Region 1

Noteworthy progress in the development of land and water resources of the Columbia River Basin through major construction and comprehensive planning, together with large-scale production of power and crops for growing markets, highlighted the year's activities of the Bureau of Reclamation in region 1. In the Pacific Northwest, construction was advanced on five major projects and two other significant developments were brought to the construction stage. A comprehensive plan for the most beneficial use of water and other physical resources of the Nation's second largest river was completed. Crop production was at a record high, and the hydro-electric power output in six plants was at maximum capacity to meet an unprecedented peacetime electrical load.

Operation and maintenance.—Farmers on 14 Federal Reclamation projects produced $210,337,163 in crops in 1946, exceeding the previous high set in 1945 by $20,415,509. The average per-acre return on the 1,834,144 acres under cultivation for which the Bureau provided a full or supplemental supply of water was $114.35. This is also a new record, the previous peak being the 1945 average of $105.98.

Tremendous contributions to alleviate world food shortages were made on the irrigated farms of the Northwest. Among the quantities of basic crops produced were: 46,496,553 bushels of potatoes (enough to provide a year's supply for approximately 22,000,000 people), 10,597,512 bushels of vegetables and truck crops other than potatoes, 1,005,568,036 pounds of fruit, 2,152,819 tons of sugar beets, and 2,348,917 tons of hay and forage crops.

Major expansions in irrigated acreages totaling 10,065 were made on two projects under construction, and initial water delivery on the Deschutes project in central Oregon during the spring of 1946 made it possible to irrigate 6,988 acres of land on this new development.

On two projects much-needed public land was made available for some of the tens of thousands of veterans of World War II who are seeking settlement opportunities. The homestead opening graphically demonstrated the tremendous demand for farm land. Twenty-eight farm units, comprising 1,700 acres, were awarded on the Roza division of the Yakima project on April 25. A total of 13,366 applications were mailed out to interested persons. Of the 1,501 persons who returned applications, 1,277 were found qualified.

On June 14, a drawing was held at Jerome, Idaho, to award 43 homestead units in the Hunt area of the Minidoka project. The Bureau mailed out 5,035 applications on request, of which 1,172 were returned.

Nine hundred and ninety-six persons were found to have the necessary qualifications. In addition to the homestead units, successful applicants won two barracks and considerable household goods and farm equipment used in the former Japanese evacuee camp at Hunt. The Bureau is custodian of the camp and responsible for selling to low bidders movable property not given to veterans.

Public land drawings during the next fiscal year will be held on the Vale project, where one unit is to be awarded to one of 42 applicants and on the Owyhee project where 3 units are to be awarded among 46 qualified applicants. Homestead units, comprising 7,000 acres on the Payette division of the Boise project and 4,600 acres on the Gooding division of the Minidoka project, will also be awarded in the next fiscal year.

Negotiations for two amendatory repayment contracts, involving the Owyhee (Oregon-Idaho) and Bitterroot (Montana) projects, were under way, and investigations were carried forward looking to new contracts in 1948 on three projects, and completion of repayment reports during the next year on four.

Of great significance to the entire Federal Reclamation program was the accomplishment made by the Tieton irrigation district in completing the repayment of its construction cost obligation of $3,597,479. It became the first Federal Reclamation project to complete repayment of the Federal investment in the irrigation works.

Land settlement and development problems in the Columbia Basin were tackled by the newly organized project development subdivision. Utilizing many of the findings of the Columbia Basin joint investigations, the organization laid the groundwork for successful settlement of the million-acre project.

Construction.—Setting the pace in construction was the Columbia Basin project. First contracts for irrigation works were completed, and installation of additional power facilities started. Irrigation construction and supply contracts totaling $20,413,091 were awarded during the fiscal year, and bids opened for an additional $113,244 in construction and supply contracts for the project irrigation system. Plans for awarding additional contracts in the 1948 fiscal year were shelved because of budgetary and appropriation restrictions.

Construction of the 6½-mile southern section of the main canal was completed late in June, more than a year ahead of schedule, at a cost of $619,000. The canal will be lined under a separate contract.

At Anderson Ranch Dam, work was advanced to bring the placing of embankment to 94 percent of completion. Major construction was shut down from January 1, 1947, to the end of the fiscal year because of insufficient funds. This will delay completion of the project until July 1949.

Construction of Cascade Dam of the Boise project was carried forward. The dam, which will ultimately store 700,000 acre-feet of water, is scheduled to be completed during the winter of 1947–48.

Work proceeded at full speed on the Deschutes project. Construction was initiated on the last 21 miles of the 65-mile main canal and on laterals to serve an additional 24,500 acres of new land. Contracts for all other features are to be let early in the next fiscal year, with completion scheduled prior to the 1948 irrigation season.

All irrigation works to serve the 47,000-acre gravity unit of the Roza division of the Yakima project were completed and placed in operation. The necessary pumping plants, discharge plants, and laterals to serve 16,000 acres in the 25,000-acre pump unit were placed under contract. A major obstacle, that of obtaining transformers and motor control equipment, will delay irrigation under the pump system until 1949.

On the Minidoka project, laterals to serve 3,500 acres of public land in the Hunt area were completed and the land opened to settlement by veterans. Contracts for the construction of a distribution system to serve an additional 4,500 acres will be awarded for completion before the 1948 irrigation season.

Two projects were being carried through the final preconstruction stage—Palisades Dam in southeastern Idaho and Hungry Horse Dam in northwestern Montana. Palisades Dam will provide supplemental water for approximately 650,000 acres of irrigated land and a full supply for some new land, produce a sizable block of power, and aid in the control of Snake River floods.

On Hungry Horse project, the preconstruction tempo continued to increase, with actual construction scheduled for fiscal year 1948. Hungry Horse Dam is to provide storage on the South Fork of the Flathead River to irrigate new land, produce power at the site, increase the firm power output of downstream plants (including Grand Coulee Dam) and provide flood control and navigation benefits.

Power development.—The real significance of Federal power in the field of industrial expansion in the growing Pacific Northwest became clearly evident during the year. Despite gloomy predictions that the war's end would see generators idle, the shift from a war economy to production of peacetime products came about remarkably fast, bringing new industries and otherwise adding greatly to the ever increasing electrical system loads. Five plants on four Bureau projects were operated at capacity or in excess.

The total output of region 1 power plants was 5,302,629,390 kilowatt-hours, and the net revenues, $6,528,573.

Grand Coulee power plant, with an installed capacity of 668,000 kilowatts, carried a peak load of 781,000 kilowatts and produced a net total of 5,097,386,000 kilowatt-hours to earn revenues estimated at $6,000,000.

The Minidoka project, with an electric plant of 13,400 kilowatt-capacity, carried a peak load of 15,900 kilowatts, and produced a net total of 110,340,900 kilowatt-hours to earn revenues of $371,671.48.

The Boise project, with the Black Canyon and Boise River power plants of 8,000 and 1,500 kilowatts, respectively, carried a peak load of 12,040 kilowatts. The two plants produced a net total of 69,742,730 kilowatt-hours, earning a total of $95,741.21.

The 2,400-kilowatt Prosser power plant of the Yakima project carried a peak load of 3,075 kilowatts and produced a net total of 25,159,768 kilowatt-hours, while earning revenues totaling $61,160.31.

Project investigations.—Working largely within the broad outlines of the comprehensive Columbia River Basin report, emphasis was placed on the completion of 47 individual project investigations, including 12 begun during the year.

Reports on four projects—Water supply, Palisades Reservoir project; Rathdrum Prairie project, Hayden Lake unit; Yakima project, Kennewick division; and Yakima River erosion survey were prepared either in preliminary draft or final form. The Lewiston Orchards project, Idaho, reported on in the preceding year, was authorized for construction.

Cooperative activities.—Cooperation was advanced on four major fronts—Federal agencies, departmental agencies, international agencies, and State and local agencies. The Columbia River Inter-Agency Committee of which the Bureau is a member was concerned largely with the problems of cooperation posed by the Columbia River Basin Report of the Bureau, by the fishery problem in relation to dams on the lower Columbia, by the problems incidental to the assembly of adequate hydrologic data and by studies of cost-benefit ratios and cost allocations.

The Interior agencies achieved a higher measure of regional cooperation through the formation of the Pacific Northwest Coordination Committee on September 26, 1946. This group made notable progress in formulating integrated programs, in proposing policies respecting fishery protection, in formulating regional policies respecting recreational development, in reviewing possibilities of phosphate development and in planning generation facilities to meet growing power loads.

International cooperation with agencies of the Dominion of Canada was advanced by the International Columbia River Engineering Committee.

Cooperation with the several States in the region was fostered both through the Inter-Agency Committee and by direct cooperation with

State officials. A larger measure of cooperation was developed in project investigation and in project operation. Likewise, cooperation was extended to many local groups interested in water resource development. The establishment of local committees, such as that operating on the Hunt unit, which are interested in contributing to land settlement is particularly worthy of note.

Region 2

The beginning of the Central Valley project change-over from construction endeavor to a combination of construction and operation became evident in region 2 during fiscal year 1947.

Despite constant pressure to step up construction tempo, the expanding operating requirements of the multimillion-dollar Central Valley project emphasized the importance of planning project operations with a degree comparable to that demanded of the designers of its world-renowned dams and canals.

An outstanding event within the region during the year occurred on the Klamath project, where 7,528 acres of fertile land were made available to 86 veterans in the first land opening since the close of World War II. Applications were distributed to 15,000 interested veterans of whom 2,028 filed papers for the land. The locally appointed examing board concluded that 1,305 were qualified to participate in the public drawing held in Klamath Falls, Oreg., on December 18, 1946. By the close of the fiscal year the homesteaders had about 90 percent of the area under cultivation.

On July 1, 1946, the region had before it a fiscal year construction program which scheduled the investment of approximately $42,700,000 toward the completion of the initial portion of the Central Valley project and $2,418,000 for construction of additional storage and flood control facilities on the Klamath project. Substantial progress was made, but the program was not fully executed as planned.

The contract earnings on the Central Valley project fell short of expectations. The orderly rate of progress of all major contractors was affected adversely by a restless supply situation that brought erratic deliveries of steel, lumber, and other essential construction materials. Markets repeatedly were scoured for items in short supply.

The authorized portion of the Central Valley project now under construction constitutes about 25 percent of the work required ultimately to provide control works for the maximum beneficial use of available water resources, and amounts to approximately 42 percent of the first and second stages of the comprehensive plan of water development proposed by the Bureau of Reclamation.

An adequate and far-sighted investment of moneys necessary for the full development of project water resources will yield benefits estimated to amount to more than a quarter of a billion dollars annually.

Project planning.—The detailed investigations program required to implement the proposals for future development with specific plans was prosecuted on a full-scale basis until near the end of the fiscal year when it became evident that funds for the succeeding year would be curtailed. A sharp but orderly retreat in the scope of the investigations program was made in the closing months of 1947 to synchronize the work with the reduced funds made available for this purpose in 1948.

The Sly Park project study, being conducted for the Eldorado irrigation district on a joint-cost basis, was brought to an advance stage of completion. Reports on the Sacramento River tributary plan, the Yolo-Solano unit of the Central Valley project, and the Santa Barbara project, were nearing completion.

Construction.—Construction on the Friant-Kern Canal from Friant Dam to the Kaweah River progressed at the fastest rate possible consistent with the existing labor and material situation. The initial section of this canal was completed June 30, 1947. Installation of drum gates in the spillway section of Friant Dam, which will increase the storage capacity of Millerton Lake by approximately 84,000 acre-feet, was brought to an advanced stage, with completion scheduled in August 1947.

On the Delta-Mendota Canal, work started on a second 12-mile section and a contract was awarded for constructing the inlet section and pumping plant.

Martinez Reservoir and the terminal section of the Contra Costa Canal were completed and work on the remaining link of the canal was in an advanced stage, as were also the Clayton and the Ynacio pumping plants. The Oroville-Sacramento section of the east side transmission line was beset with shortages of tower steel and right-of-way difficulties during the winter months but by June 30 approximately 25 percent of the towers had been erected.

At Shasta Dam three 15-foot penstocks were being completed and three 75,000-kilowatt generator units were in process of installation. Manufacturer's delay also forced a revision of the program for installing the 28- by 100-foot drum gates in the Shasta Dam spillway section.

Power.—Activity in the electric power field was given an unusual character during the year by the coincidence of a developing shortage of installed generating capacity and a short water year. By January 1 it was apparent that hydro generation at Shasta Dam would have to be curtailed sharply to store water for the irrigation season. Despite a reduced production schedule, 1,329,019,900 kilowatt-hours were generated during the fiscal year, yielding a gross revenue of $3,455,345.64.

Additional revenue of $75,000 resulted from the lease of transmission facilities.

As the year progressed, the electric utility industry in the region, this time on a basis of inadequate installed capacity, began to experience its most critical power shortage since 1924. The Shasta power plant was operated at a 13.5-percent overload during most of the year and on two occasions the principal customer, the Pacific Gas & Electric Co., requested a 20-percent overload. Danger of generator overheating made this infeasible for any sustained period. However, to meet peak loads the combined production of two 75,000-kilowatt generators was boosted to 180,000 kilowatts for short periods of time.

The widespread shortage brought several applications for power from agencies both within and from outside the region which desired to obtain energy from the Central Valley project system. A contract with the Shasta Dam area public utility district for commercial power was signed by the district directors in January. Another, with the Pacific Gas & Electric Co., reached an impasse on the principle of conveyance by the company of Bureau power to public agencies having contracts with the Bureau. At year's end, the company had not agreed to such conveyance.

Operation and maintenance.—In addition to producing power, Shasta Dam reduced flood peaks, and released 1,100,000 acre-feet of water to irrigate 250,000 acres of crops in the Sacramento Valley, maintain a navigation channel above Sacramento, withhold ocean water from 450,000 acres of Delta area lands, aid in propagating salmon, and make possible the proper operation of the Contra Costa Canal. In the current short water year, Shasta Dam releases were controlled within narrow limits to insure an adequate water supply in 1948 should the dry period continue.

Water-use studies, covering available supplies and probable service area demands for Central Valley project water, indicate the probability of a future demand considerably in excess of foreseeable project supplies, particularly in the southernmost part of the San Joaquin Valley within the Friant-Kern Canal service area. In the Delta-Mendota Canal area, four water districts have been formed to obtain supplemental water when it becomes available.

The Central Valley project allocation report and schedule of repayment was completed, presented to the President and the Congress, and released as House Document No. 146, Eightieth Congress, first session.

Region 3

The multiple-purpose benefits from Reclamation developments in region 3 continued to play a major role in the economy of the southwest while the Bureau's construction and planning program continued o make progress.

Five highlights stood out in the Reclamation program in region 3 during the 1947 fiscal year: (1) Farmers on projects served by Reclamation facilities had one of their most prosperous years; (2) Bureau hydroelectric plants continued to make this region the "powerhouse" of the southwest; (3) construction was expedited on three major projects; (4) investigations continued on 11 potential projects; and (5) plans for opening land to homestead entry by war veterans largely were completed.

From a cultivated acreage in 1946 of 784,333 acres, farmers in the Imperial, Yuma, and Salt River Valleys produced crops valued at $134,952,091, exceeding the previous year by 21 percent.

Generating slightly over 5 billion kilowatt-hours of hydroelectric energy for the year ending June 30, the Hoover and Parker power plants and a small plant on the Yuma project furnished about 40 percent of the power requirements of southern California, Arizona, and southern Nevada.

Construction on the Davis Dam project, the Gila project, and the Coachella Main Canal was continued on schedule. Excavation of the diversion channel at Davis Dam was substantially completed and most of the major equipment for the power plant was ordered. On the Yuma Mesa division of the Gila project an irrigation system sufficient to serve 10,000 acres of land was completed. Plans were virtually completed for the opening of 4,941 acres of predeveloped public land on the Gila project and 1,400 acres of public land on the Yuma project for homestead entry by war veterans in the fall of 1947.

Looking to future Reclamation developments, investigations of 11 potential projects in the lower Colorado River Basin were continued, and an interim report on the Central Arizona project issued.

Davis Dam project.—Substantial progress was made on this multiple-purpose project despite adverse foundation conditions encountered in the excavation for the fore-bay and power-plant installations. In accordance with the recommendations of a consulting board, which was convened at the dam site early in March, an extensive program of foundation grouting was initiated upon completion of the excavation. This work, still in progress at the end of the year, will insure a stable foundation for the structure, which was modified somewhat from the original plans at some increase in cost.

Transmission systems.—The field location, design and construction of the Parker-Davis transmission lines and substations moved forward. At the close of the year construction of the second Phoenix-Tucson 115-kilovolt line was underway. Faced with delayed deliveries of major items of terminal equipment for the Parker-Gene 230-

kilovolt interconnection, two 45,000-kilovolt-ampere transformers were obtained from the Atomic Energy Commission at Oak Ridge, Tenn., and three 25,000-kilovolt-ampere transformers and related switching equipment from the War Assets Administration at Henderson, Nev., for temporary installation. These installations were placed in service June 1, 1947, just in time to assist Arizona irrigators in pumping water.

Irrigators in Arizona use both gravity and pumped water. Much of the gravity water is used to generate hydroelectric power for operation of the irrigation pumps. The drought-created shortage of gravity water increased demands for pumped water and at the same time curtailed production of power for operation of the pumps. The Bureau, by means of the temporary installation of the Parker-Gene interconnection, was, at the end of the fiscal year, transmitting over 1,000,000 kilowatt-hours each day from Hoover Dam and southern California steam plants into Arizona to alleviate the power and water shortage.

Coachella Main Canal.—Construction of the final reach of the 123-mile Coachella Main Canal was initiated. It is scheduled for completion in fiscal year 1948. Negotiations with the Coachella Valley County water district were under way to provide for construction of a distribution system at an estimated cost of $13½ million with an allocation of $4½ million nonreimbursable funds to the construction of storm water protective works.

Gila project.—Two major construction contracts were awarded, one for construction of A canal and A laterals and the other for laterals from A and B canals. The first contract was virtually completed at the end of the year while the second was about one-fourth completed.

Plans for opening 54 farm units on the Yuma Mesa division ranging in size from 40 to 160 acres were substantially completed.

Yuma project.—A remedial drainage program, pursuant to agreement with the Yuma County Water Users' Association, was launched.

Preparation was made for the issuance in the fall of 1947 of a public notice opening 28 farm units on the Yuma Valley and Reservation divisions of the project. Much of the land to be homesteaded on the Yuma project was previously leased by the Bureau to private farmers and is in an excellent productive condition.

Rehabilitation plans for the Yuma project were advanced through agreement with the water users to a survey supplementing the reconnaissance previously made.

Boulder Canyon project.—The tunnel and river channel improvements immediately below Hoover Dam were completed in April under a 2.6 million dollar contract.

Completion of the first 10 years of power production by the Hoover power plant was commemorated October 23, and the two-millionth visitor was recorded in September.

All-American Canal.—The Imperial irrigation district at midnight February 28, took over the operation and maintenance of the All-American Canal from a point just below Pilot Knob wasteway to the end, exclusive of the Coachella branch. A contract was made with the Imperial irrigation district for the operation and maintenance, care, and custody of the 540-acre East Mesa predevelopment tract for a 10-year period.

San Diego project.—Contract work on this project at the close of the year was 90 percent complete and it was anticipated that by November 1947 the aqueduct would be ready to deliver Colorado River water to San Diego and other municipalities comprising the San Diego County Water Authority.

Salt River project.—A reconnaissance rehabilitation survey for this project was completed. The Bureau conferred with the water users' association on the work to be done, repayment, and the gearing of operations and maintenance work to construction.

A land pattern study of the project was initiated in cooperation with the water users as a step toward agreement on procedures for enforcement of the 160-acre law.

River control.—Field offices for physical control of the river were established at Needles and Blythe, Calif. A major construction program is planned in the Needles area where the river has raised its bed over the entire 12-mile section from Needles to Topock, endangering many municipal and railroad installations. Award was made for the construction of a hydraulic dredge for permanent clearing of the channel. It will be available for operation in fiscal year 1949.

The maintenance of a temporary rock diversion weir at the Palo Verde irrigation district's headworks on the Colorado River near Blythe, Calif., was continued and a 2-mile pilot cut-off channel near the Palo Verde drain outlet was constructed pending dredging of a new river channel in this area.

A flood warning system using radio communication was placed in operation in the Bill Williams River basin in Arizona.

Subbasin and small project reports.—A preliminary report on the Virgin River Subbasin was completed. Work on the Muddy River and Little Colorado River subbasin reports was suspended in favor of work on individual project reports within these basins on which work was well advanced. Work on the upper Gila subbasin is being continued. A report on preliminary investigations of a permanent solution of the Palo Verde irrigation district diversion problem was prepared jointly by the Bureau of Reclamation and the Bureau of

Indian Affairs and was under review at the close of fiscal year. A report on the Snowflake project, Arizona, was completed. Reports on eight small irrigation projects in Utah, Nevada, Arizona, and California were under preparation.

Central Arizona project.—Investigations of the Central Arizona project were continued, financed by funds provided jointly by the Bureau of Reclamation and the State of Arizona. This project contemplates furnishing from the Colorado River a supplemental water supply for some 600,000 acres in the valleys of the Salt and Gila Rivers near Phoenix, Ariz. It involved several major features which include Bridge Canyon Dam and power plant on the Colorado River, Coconino Dam on the Little Colorado River, Bluff Dam on the San Juan River and a 235-mile aqueduct. All investigational activities are now confined to the Parker diversion route. A preliminary project report for the Central Arizona project, involving the Parker Route, is expected to be completed in the fiscal year 1948.

Region 4

Region 4 maintained its status during fiscal year 1947 as second ranking crop producer and first in number of operating projects, but new development was hampered by a major problem inherent in the absence of a single potential irrigation project in the entire Lahontan, Bonneville, or Upper Colorado River Basin that is self-sufficient from the 40-year repayment standpoint.

A number of power projects can be built that will aid in repayment of irrigation construction costs in Nevada, Utah, western Colorado, western Wyoming and bits of Idaho, New Mexico, and Arizona. Development of the potential irrigable land to the fullest extent is not possible, however, unless the Congress should act favorably upon proposals for further liberalization of the law governing repayment of project construction costs.

Regional planning engineers viewed the problem realistically and achieved definite progress during the year. Spurred by the realization that not one power project is yet under construction, although the region has a potential power capacity of more than 2¼ million kilowatts (25 percent more than the Bureau's entire installed capacity including Grand Coulee, Hoover, and Shasta plants), regional planning engineers: (1) Completed draft of a Lahontan Basin water resources development plan to yield agricultural-power benefits aggregating 6 million dollars annually; (2) revised a report setting forth potential irrigation-power benefits totaling 23 million dollars annually from the development of Bonneville Basin water resources; (3) assisted in submitting to the Congress, with the considered comments of the seven States affected, a comprehensive report on the Colorado River showing that basin-wide development of the irrigation-power potential alone would bring new benefits totaling 137 million dollars annually.

All three reports indicate that the pooling of power revenues through basin-wide planning will make feasible scores of vitally needed irrigation projects otherwise financially doomed to dormancy.

Water users of the Provo River project, Utah, won commendation by being among the very first, if not first, in the Nation to resolve the problem of increased construction costs by executing amendatory contracts increasing by approximately 50 percent their repayment liabilities for the Deer Creek division and Salt Lake Aqueduct.

Crop values from 16 projects jumped to $39,281,000.

Design and construction.—Specifications were issued and bids received for an expanded construction program exceeding $9,000,000. Awards actually made exceeded $4,000,000, including construction of Jackson Gulch Dam and inlet and outlet canals, earthwork, concrete pipe lines, and structures to complete the Jordan Narrows siphon and pumping plant; and clearing of Scofield Reservoir.

Bids for construction of Jordan Narrows siphon steel pipe sections, the remaining 3.7 miles of the Duchesne Tunnel and 5.5 miles of the Salt Lake Aqueduct in Provo Canyon were rejected as excessively high.

Project planning.—In addition to advancement of the Colorado River, Bonneville, and Lahontan Basin reports, final reports were prepared for the Hammond project in New Mexico and the Gooseberry project in Utah. Congress late in the year authorized construction of the Paonia project, Colorado, after receiving the Bureau's report based on a revised project plan.

Investigations were advanced to the point where reports can be issued soon on the Maled Valley project, Idaho; the Silt, Collbran, Florida, Dolores, Pine River project extension and LaPlata projects, Colorado; Emery County and Jensen projects, Utah; Lyman project, Wyoming. Investigations were continued on 27 other projects.

An aerial topographic survey of the rugged inaccessible area comprising the lower 280 miles of the San Juan River in remote southeastern Utah was made as part of the Bluff project investigation.

Operation and maintenance.—Regular operation and maintenance activities were conducted for the delivery of water to 16 projects, including operation during construction of the Scofield project until January 1, 1947, and the Provo River project, both in Utah. The only works operated by the Bureau were the Gravity division, Grand Valley project, Colorado, and storage or other reserved works on the

Pine River project, Colorado, and Newton and Scofield projects, Utah. Water users' organizations operated the other projects.

A gain of $1,161,000 in crop values over 1945 was due principally to an increase of 41,700 in cropped acreage. The total acreage of 527,770 on the 16 operating projects produced crop receipts totaling $39,281,000. Mancos and Eden projects, where construction work by the United States remained suspended, are not included in these totals.

Reclassifications were in progress to fix the present status of Newlands and Grand Valley project class 5 lands on which construction charge repayments were suspended under the 1926 Adjustment Act.

The amendatory repayment contracts with the Provo River Water Users Association and the Metropolitan water district of Salt Lake City were executed in December 1946, increasing the respective obligations to repay the Deer Creek division and Salt Lake Aqueduct construction costs from $7,600,000 to $11,400,000, and from $5,550,000 to $8,043,650, respectively.

Construction was resumed on the Jackson Gulch Dam, key structure of the Mancos project, Colorado, after the Congress on June 25, 1947, approved negotiations of an amendatory contract with the Mancos water conservancy district increasing its reimbursable construction cost obligation from $600,000 to $900,000, and extending the repayment period from 40 to 60 years.

Region 5

There were 179,407 acres of land irrigated on the four projects that were operated in region 5 during the calendar year 1946. This acreage was distributed over 7,363 farms and supported a farm population of 34,339. The gross crop incomes varied from $85.53 per acre on the Tucumcari project to $256.77 on the Rio Grande project. The gross crop income from the irrigated land amounted to $40,535,293, or $225.94 per acre.

Construction was in progress on five projects during the fiscal year 1947. Part of the program includes the construction of additional transmission lines for the Elephant Butte power system on the Rio Grande project, from which 80,894,096 kilowatt-hours of energy were delivered and revenue of $320,211 returned.

The planning activities have included work on 9 river basins, 2 subbasins, and 18 projects. In addition, 15 reconnaissance, special, and supplemental reports have been in progress.

The planning program for the fiscal year 1947 contemplated that 23 reports of various categories would be completed. Of the 11 project reports included in the above, final drafts were completed for Robert

Lee and Fort Sumner projects, preliminary drafts were completed for the Canton and Balmorhea (ultimate) projects; reports covering the amendment of the authorization for the Valley Gravity and San Luis (Conejos) projects were prepared. Two of the reconnaissance reports, the Fort Gibson and Mud Creek projects, were completed. The two recreational reports were completed.

The status of construction work scheduled for completion during the fiscal year 1947 was as follows: Tucumcari project, 62 percent complete (cost basis); W. C. Austin project, 66 percent complete (cost basis); Balmorhea project, all scheduled features, 100 percent complete; Colorado River of Texas project (Marshall Ford Dam), installation of scheduled work delayed because of lack of material; Rio Grande project, scheduled work on spillway and Alamogordo-Hollywood transmission line delayed on account of unavailablility of materials; contract for Elephant Butte-Socorro transmission line not awarded.

Construction.—A total of five projects were under construction in region 5.

The W. C. Austin project receives its water from the Lugert-Altus Reservoir on the north fork of the Red River. The dam is complete except for the installation of radial gates on the controlled spillway and operating bridge across the dam. The main canal and most of the Altus and west canals are complete, and irrigation of a portion of the land is under way.

All contract construction on the Balmorhea (modified) project is complete. Minor repairs for the protection of the Madera diversion dam and the Phantom Lake canal siphon are being made by Government forces.

Rio Grande project storage and power divisions remaining construction work for which appropriations are available consists of completion of power transmission facilities to Hollywood on the east and to Albuquerque on the north, alterations to Elephant Butte Dam spillway, and miscellaneous features.

The Lower Colorado River Authority has assumed responsibility for the operation and maintenance of the Marshall Ford Dam in accordance with the contract of 1941. Remaining work to be performed consists of the installation of a gantry crane, a standby generating unit and parapet lights.

Water for the Tucumcari project is obtained from the Conchas Reservoir on the South Canadian River and is brought to the 45,000 irrigable acres by a canal system totaling 109 miles in length. Approximately 56 miles of the Conchas Canal and 8 miles of the Hudson Canal have been completed and irrigation water is being furnished to 2,526 acres of irrigable lands in the first unit.

Work scheduled.—The 1948 fiscal year program of construction work on the five projects is expected to consist of the following: W. C. Austin project, completion of storage and canal systems; completion of lateral system except for a few months work on the last of the Ozark laterals; and completion of drain C. Balmorhea (modified) project, repair work for the protection of the Madero diversion dam and Phantom Lake canal siphon, expected to be completed by September 1947. Colorado River of Texas project (Marshall Ford Dam), complete installation of Gantry crane, a standby generating unit, and parapet lighting. This will complete the construction work. Rio Grande project (storage and power division only), completion of alterations of Elephant Butte Dam spillway; complete transmission line to Hollywood on the east with temporary substations at Alamogordo and Hollywood; and the practical completion of transmission facilities at Socorro, N. Mex., on the north. Tucumari project, completion of Conchas canal to mile 59.4, the Hudson canal to mile 16.8, and lateral units 1 through 5. This work will make it possible to furnish water to an irrigable area of approximately 23,000 acres.

Planning developments.—Planning work for water resources development included investigation of nine river basins, 2 important subbasins, 18 projects, 11 reconnaissance or interim studies of projects, 2 special studies, and 2 supplementary studies of authorized projects.

Preliminary drafts of departmental reports were completed on Canton, Robert Lee, Fort Sumner, and Balmorhea (ultimate development) projects. Final drafts of reports were completed on Fort Sumner and Robert Lee projects. The Nueces River Basin report was forwarded to the Congress during fiscal year 1947. Reconnaissance reports were completed on the Big Creek, Mud Creek, and Fort Gibson projects. A report seeking amendment of authorization was completed on Valley Gravity project. A reconnaissance report on Zapata project has been initiated. A supplemental report was completed on San Luis Valley project (Conejos division) in accordance with the original project authorization.

It is expected that the preliminary draft of the report on Cotulla project will be completed during the fiscal year 1948. Final drafts of reports are expected to be completed on the Middle Rio Grande, Balmorhea, and Canton projects. Studies will continue on the Brazos and Pecos River Basins, and on Valley Gravity, Carlsbad, Vermejo, and Big Creek projects, and on San Juan-Chama diversion.

Because of reduced funds for planning, the reports on Colorado River of Texas, Rio Grande and Guadalupe Basins, and all project investigations which were initiated but not completed at the beginning of fiscal year 1948, will be continued only far enough to preserve the data already collected.

Operation and maintenance.—The operation and maintenance activities of region 5 were confined to four projects.

Rio Grande project, New Mexico-Texas.—Some 156,576 acres, including 7,605 acres of temporarily suspended land, of the 178,073 acres of project land in New Mexico and Texas were irrigated in 1946. Gross crop returns for 1946 were $38,275,850, an average gross return of $256.77 per acre.

Carlsbad project, New Mexico.—Need for rehabilitation on the Carlsbad project is increasingly evident. Studies looking toward such rehabilitation include not only engineering features but economic analyses of the repayment ability of the project. The gross crop returns were $1,984,380, or an increase of $444,414 over 1945. A portion of this increase is due to irrigation by pumping from wells on project farms.

W. C. Austin project (previously Altus project), Oklahoma.—Irrigation facilities to serve approximately 10,000 acres of project lands were completed by June 30, 1947. Determinations just completed indicate that the project will contain approximately 50,000 acres of irrigable land when construction is completed. The 451 acres irrigated in 1946 had a gross crop return of $58,954, or an average of $130.72 per acre. There were 65,633 acres dry-farmed in the project area, with gross crop returns of $1,449,981 and an average of $22.09 per acre. Project facilities will be completed to supply water to approximately one-half of the project's irrigable acreage by the end of calendar year 1947. Land preparation for irrigation is progressing rapidly.

Tucumcari project, New Mexico.—Practically all of the 5,880 acres in unit No. 1 were cleared and prepared for irrigation by June 30, 1947. During 1946, 2,526 acres were irrigated, bringing gross crop returns to $216,109 or an average of $85.53 per acre. Some 107 farm units are being developed although the population on the project farms is only 185.

Balmorhea project, Texas.—Construction work on presently authorized features was practically completed by June 30, 1947. The 1946 Crops and Livestock Census indicates that 7,007 acres were irrigated on 112 project farms of the Reeves County water improvement district No. 1 with gross crop returns of $592,726, or an average of $84.59 per acre.

Power facilities.—The hydrogenerating plant at Elephant Butte Dam consisting of three 8,100-kilowatt generating units and the transmission system from this plant constitute the existing power facilities in region 5. The estimated annual salable output of the plant amounts to 91,000,000 kilowatt-hours. Total energy delivered in the fiscal year 1947 was 80,894,096 kilowatt-hours, which produced a revenue of $320,211.34. Generation was below normal due to low water conditions in Elephant Butte Reservoir.

The following 115,000-volt transmission lines are under construction or authorized: Alamogordo to Hollywood, N. Mex., for delivery of power to Community Public Service Co. and Otero County Electric Cooperative at Hollywood, 39 miles; Elephant Butte to Albuquerque for delivery of power to Socorro Electric Cooperative at Socorro, N. Mex., Community Public Service Co. at Socorro and Public Service Co. of New Mexico at Albuquerque, 144 miles.

Region 6

The past year in region 6 has been one of preparing the groundwork for an expanded program of work in the immediate future. The problems have been more clearly outlined, a definite plan has taken shape, and a good beginning made in securing properly trained personnel.

Properly to evaluate the many projects a thorough examination of all resources—land, water, power, mineral and wildlife—was emphasized more than ever in the work program. A continuing investment in investigations and planning will be required for several years in order to develop the complete plan of conservation, control and utilization of the Missouri Basin's water resources.

Investigations and preconstruction.—Aerial topographic mapping was carried out for 2,600 square miles of the Clarks Fork River and Tongue-Powder River subbasins and a contract awarded for aerial mapping of 7,830 square miles of the Upper Missouri subbasin.

Inasmuch as planned developments on the lower Marias will utilize a large part of the existing run-off, the possibilities of importing water to the upper Marias basin are being explored and preliminary conferences have been held with Canadian officials.

A preliminary reconnaissance was made of irrigation possibilities in North Dakota by pumping from the Garrison Reservoir to be constructed by the Corps of Engineers, United States Army.

Montana

Canyon Ferry unit.—Designs and specifications were 33 percent completed for the dam and powerplant. Designs and specifications for the road relocation were 90 percent completed. Appraisal of reservoir right-of-way was completed.

Glasgow Bench unit.—Aerial photographs of the irrigable lands were 90 percent completed, detailed studies of pumping from Fort Peck Reservoir and relift plants were made, and detailed topographic mapping started.

Hardin unit.—Activity was centered on foundation drilling of the damsite and tunnel exploration of the abutments. Detailed surveys were made and preliminary designs of the dam started.

Lower Marias unit.—Surveys of the damsite were completed and designs and specifications were about 40 percent completed for the dam. Drilling of the foundation and aggregate exploration were practically finished. Detailed topographic surveys of irrigable lands were two-thirds finished, and land classification was completed. Detailed field information of the first 13 miles of the main canal was obtained for preparation of final structure designs. The excess land appraisal report was completed.

Missouri-Souris unit.—The location of a diversion dam was studied intensively, drilling of three axes completed and detailed topography taken. Topography was taken along the main canal and alternate routes studied. Big Muddy dam site was surveyed and drilling completed.

South Bench unit.—Topographic mapping and land classification of the irrigable lands were completed. The route of the canal through the canyon below Willow Creek Dam was surveyed.

Yellowstone River pumping units.—*Savage*—Surveys of irrigable lands were completed, and detailed information for designs and specifications prepared; *Sadie Flat*—All topographic surveys, structure surveys, and detailed information for designs and specifications taken.

North Dakota

Heart River Unit—Heart Butte Division.—A water users' district was organized and repayment contract negotiations carried into the final stage. Appraisal reports, land classification, and surveys of damsite, reservoir and pumping units were completed. Preliminary designs and estimates and a development report were prepared. Final designs and specifications for Heart Butte Dam were 55 percent completed. Dickinson division preliminary cost estimates were prepared and studies of municipal water requirements and repayment made.

Knife River unit.—Foundation exploration was completed at the Broncho Dam site and Beulah diversion site. Topographic surveys of project lands were made and land classification was 70 percent completed.

Missouri-Souris unit.—Topographic surveys were completed for Crosby Reservoir, Grenora pumping plant, Crosby power drop, Sheyenne Dam and Reservoir site; detailed topography about 42 percent completed for the Souris Canal. Drilling programs at the Sheyenne Dam site, Grenora pumping plant and Crosby power drop were completed. Work was started on spot check areas for land classification and development studies. Aerial photographs were received and topography taken on 18,000 acres.

North Dakota pumping units.—Field work and land classification were active on the Painted Woods, Hancock Flats, Oliver-Sanger, and Fort Clark units. Designs and specifications were nearly completed for Wogansport and Square Butte units.

South Dakota

Grand River unit.—Aerial photography of the project lands was completed, detailed surveys made of the dam and reservoir at Shadehill, and drilling and aggregate exploration well advanced. Detailed topographic surveys and land classification started.

Oahe unit.—Location surveys were completed and strip topography taken along 20 percent of the 124-mile James River Canal line. Topography was taken on the Blunt Reservoir site, and on some 22,000 acres of spot check areas for land classification and development studies. The Huron Demonstration Farm, with planting in the spring of 1946 and 1947, showed harvest results definitely favorable to irrigation in a normal dry-farming year.

Rapid Valley unit.—A preliminary reconnaissance of the Pactola Reservoir site was made.

Wyoming

Owl Creek unit.—Spot check areas were mapped for development studies, and detailed land classification completed. Revision of designs and specifications for Anchor Dam was started.

Paintrock unit.—Plans and specifications for Lake Solitude Dam were 25 percent completed. Detailed surveys of the Manderson unit were completed, and land classification started.

Construction

Angostura unit.—A $4,237,476 construction contract for Angostura Dam was awarded and notice to proceed issued in September 1946. Stripping of the foundation and excavation for cut-off trenches are nearly complete, involving 275,000 cubic yards or 32 percent of the contract. Field surveys of the main canal location and designs were 50 percent completed. Development and economic studies are being made in cooperation with the Soil Conservation Service.

Boysen unit.—The preconstruction work has been completed, and designs and specifications were 82 percent completed for the dam, railroad relocation and powerhouse. Negotiations for rights-of-way, both private and Indian lands, are continuing. A contract for relocation of U. S. Highway No. 20 in the amount of $742,407 was awarded and

80 percent completed by the end of the fiscal year. A contract for $29,687, for a temporary power line to furnish power for construction and the camp, was awarded and construction completed.

Buffalo Rapids project No. 2.—A contract for $256,033 was awarded for construction of the Fallon pumping plant, relift plant, canals and laterals and was 59 percent completed by July 1, 1947.

Milk River project, Dodson pumping unit.—The contract for construction of a pumping plant and laterals in the amount of $64,167 was completed.

Riverton project.—The extension of irrigable areas resulted in the award of two contracts, one of $188,604 for construction of the pilot canal and lateral system, and another for $185,560 for construction of the Lost Wells lateral system.

Shoshone project.—Two contracts were awarded totaling $676,484 for extension of the Heart Mountain Canal and construction of lateral systems. A contract for $366,399 was awarded for the Heart Mountain power plant, 2 miles below the Shoshone Dam, and a transmission line contract for $177,485 was also awarded.

Power.—Preparation for marketing power from more than 1,000,000 kilowatts of new generating capacity to be installed at Federal multiple purpose dams was a major task during the fiscal year. The Bureau of Reclamation will market all power produced at its own dams, and also has been designated to market the power generated at the existing Fort Peck project and other dams to be constructed by the United States Army Corps of Engineers on the Missouri River in North Daktota and South Dakota.

Close cooperation was maintained with the Federal Power Commission and the Corps of Engineers in determining the size of the initial and ultimate power installations at the Garrison and Fort Randall Dams. Preliminary plans were prepared for a transmission system, comprising over 5,000 miles of high-voltage lines, required to interconnect the existing and proposed power plants and to carry power from them to the load centers. Additional amendatory contracts were concluded with the Montana-Dakota Utilities Co. to provide for serving preferred customers in western North Dakota and the northern part of South Dakota.

During the past year contracts were either executed or being negotiated to serve 12 cooperatives in this region. A total of 250 million kilowatt-hours of electrical energy was generated during the year by the three hydropower plants in region 6.

Project operation and maintenance.—Settlement opportunity for qualified veterans was a prime objective in region 6, and during the year approximately 7,720 acres or 83 farm units were opened to homestead entry.

Land development and settler assistance have been noteworthy features of the settlement program, in cooperation with the State department of agriculture, the Veterans' Administration and the local United States Department of Agriculture.

Crops valued at $16,702,699, an all-time high record, were produced during 1946 on Bureau-constructed projects in the region. The net area under cultivation was 377,267 acres, making the average per acre return $49.57 or 128.4 percent of the previous high return in 1945.

Operation and maintenance activities have included the completion of a rehabilitation survey of operating projects, reclassification of project lands and an economic survey preparatory to negotiation of new and amendatory repayment contracts. Problems related to land development and multiple-purpose projects, embracing many features other than irrigation, such as hydroelectric power, flood control, navigation and recreational activities, have required the development of new techniques and procedures on the reimbursability determination of the individual project.

Region 7

Region 7 boundaries include five river subbasins of the Missouri River Basin and the upper Arkansas River Basin above Ellinwood, Kans. Operating projects consist of the Kendrick, North Platte, and Mirage Flats projects. Minor construction continues on Kendrick and Mirage Flats. Major construction during the fiscal year continued on the Colorado-Big Thompson, the Nation's largest transmountain diversion project, and on parts of the Missouri River Basin project.

On the Colorado-Big Thompson project, fiscal year 1947 saw most of the large contracts let for the project works which will provide supplemental water for some 615,000 acres of presently irrigated farms. During impressive ceremonies in June 1947, the Alva B. Adams Tunnel was opened and water from the western slope poured through it and temporary emergency facilities provided by the water users to irrigate farm lands east of the Rockies. Construction was initiated on two additional units of the Missouri River Basin project and plans for a start of construction were well under way for four additional units. Investigations were continued on comprehensive plans for the five subbasins of the Missouri River Basin in region 7 and for the two large transmountain diversion projects in Colorado.

At the close of the fiscal year 1947, accomplishment of the Bureau of Reclamation work had reached an unprecedented total of nearly 50 million dollars in outstanding contracts on the approved regional programs. Construction contracts were generally affected by labor and housing problems, and shortage of materials, particularly of equipment.

Region 7's conservation task includes flood control, silt reduction, recreational and wildlife development, water supply, and irrigation involving six major river basins located in the States of Colorado, Wyoming, Nebraska, and Kansas. The task is complicated by problems involving interstate water compacts with Colorado-Kansas, Colorado-Nebraska, Colorado-Wyoming-Nebraska, and Nebraska-Kansas, and the dependency of the transmountain diversion plans on the outcome of the Colorado River Basin-Upper Basin States' compact yet to be worked out.

The potentialities of this region, based upon conservation estimates, may reach 2 billion dollars of new work, 2.5 million acres of supplemental and new irrigation and 1.5 million kilowatts of power capacity from multiple-purpose projects.

A review of the Reclamation program for region 7 reveals a considerable speed-up during fiscal year 1947. More than $10,000,000 in contracts were awarded for the Colorado-Big Thompson project and on the Missouri River Basin project work was keyed to a high pitch.

At the start of fiscal year 1947 the several units of the Missouri River Basin project were in various stages of investigation. On most of the units selected for construction, detailed surveys were fairly well advanced during the fiscal year with the initial Missouri River Basin construction continuing on the Kortes Dam and power plant which started near the end of fiscal year 1946. Fiscal year 1947 witnessed the start of construction on Enders Dam and the signing of the first combined irrigation repayment and water service contract by the Frenchman-Cambridge water users. Detailed surveys and designs were readied for other facilities of the Missouri River Basin project.

The objectives of 1947 were to have nine group A units in the Missouri River Basin under construction. Of these nine, Kortes, transmission lines and Glendo were in the North Platte subbasin. The Frenchman-Cambridge, Bostwick, North Republican, Republican Wells, Kirwin, and Cedar Bluff were in the Kansas River subbasin.

North Platte subbasin.—In the North Platte subbasin, construction work on the Kortes Dam and power plant unit of the Missouri River Basin project was advanced to 30 percent physical completion of the total work involved. The power plant, when completed, will have an installed capacity of 36,000 kilowatts and will generate annually about 150,000,000 kilowatts of electrical energy. Work was started on the transmission lines unit with material purchases and completion of plans and specifications for the Sidney-Gering 115-kilovolt line. Several damsites were explored for Glendo Reservoir and plans proceeded on the assumption that flood-control operation of the reservoir would permit early construction of the dam.

Work on two transmountain diversion projects was shelved during the year for lack of funds. Special studies were initiated during the year to consider rehabilitation plans for the operating North Platte project.

South Platte subbasin.—The South Platte subbasin includes the Colorado-Big Thompson project, which is under construction, and the proposed Blue-South Platte diversion project. On the Colorado-Big Thompson project, awards made for construction of the Granby pump plant and canal and the remainder of the Estes Park aqueduct and power system, will complete the transmountain diversion portion. Other new construction includes four tunnels of the Horsetooth feeder canal on the eastern slope. Construction continued on the Ramshorn and Prospect Mountain tunnels, the Granby Dam, and the Horsetooth Reservoir.

South Platte subbasin water supply studies were initiated during the fiscal year and were directed principally to the determination of the total ground water storage capacity of the subbasin and the search for reservoir sites to be used principally for reregulation of return flows.

The nearly complete Blue-South Platte project report reveals possible additional irrigation for 400,000 acres and power development totaling 300,000 kilowatts.

Upper Arkansas River Basin.—In the upper Arkansas River Basin, the Gunnison-Arkansas project report is nearly 80 percent complete. A basin-wide report for the upper Arkansas River Basin is approximately 75 percent complete. During the fiscal year, the boundaries of the region were extended downstream in this basin to Ellinwood, Kans., in order to include in the basin study approximately 40,000 irrigable acres of land, the balance of potential irrigation area in the basin. Development of this basin indicates irrigation possibilities for 640,000 acres and power capacity of nearly 700,000 kilowatts.

Kansas River subbasin.—In the Kansas River subbasin, notice was given to the contractor on January 20, 1947, to proceed with construction of Enders Dam of the Frenchman-Cambridge unit. An irrigation repayment contract was signed May 29, 1947, and ground-breaking ceremonies were held the same day. At the close of the fiscal year, 19 percent of the dam work had been completed. Cambridge diversion dam and Cambridge canal construction is set to start early in fiscal year 1948. All field work was completed and plans and specifications were well-advanced for the proposed Medicine Creek Dam for this unit. The reservoirs of the Frenchman-Cambridge unit in addition to providing needed flood control will store water to build up low-summer flows in the Republican River Basin for the irrigation of 35,520 acres of new land and to supply supplemental water for 17,620 acres now inadequately irrigated.

Initial diversion dam canal plans for the Bostwick unit were made ready for construction, but since this unit covers areas in Nebraska and Kansas, irrigation districts must be organized in each State. The complex legal situation in Kansas has retarded execution of irrigation districts and the date for execution of an irrigation repayment contract for the Kansas area is at present uncertain. The Bostwick unit will provide for irrigation of approximately 90,000 acres of land in the Republican subbasin. Storage regulation will be provided at the Harlan County Reservoir, which is now under construction by the Corps of Engineers. Coordination of interests in the design of Harlan County Dam has been accomplished with the Corps of Engineers, but circularization of the petition for formation of a Nebraska district organization awaits the execution of a reservoir operation agreement between the Corps of Engineers and the Bureau of Reclamation. Detailed land classifications and topographic mapping of irrigable lands on this unit are approximately 40 percent complete.

On the North Republican unit, the principal accomplishment has been the completion of detailed topographic surveys of all irrigable land, the topography for the Wray Reservoir and dam site and initiation of a drilling program at this site. Additional work on economic and hydrologic studies has been accomplished. The North Republican unit would provide irrigation for 2,080 acres of new land in Nebraska and supplemental water for 3,340 acres in Colorado and Nebraska. The Republican Wells unit areas have been estimated as 23,500 acres in Kansas and Nebraska.

Work on the Republican subbasin report of the Kansas River subbasin is about 70 percent complete. Preliminary drilling operations were completed for the Bonny dam site.

Further field work on the Kirwin Dam and on Cedar Bluff dam site No. 1 was deferred during the fiscal year owing to difficulties regarding water rights and repayment contracts under existing Kansas laws, and selection of an alternate dam site.

Considerable work for the Smoky Hill subbasin was accomplished during the fiscal year on studies for determination of flood control benefits in cooperation with the Corps of Engineers. During the fiscal year, land classifications and water-supply studies for the Smoky Hill subbasin were completed and considerable work was completed on preliminary canal surveys. Studies were also made regarding municipal water supply and sewage disposal for towns and cities. Work on the Smoky Hill subbasin report of the Kansas River subbasin was approximately 75 percent complete.

Lower Platte subbasin.—In the Lower Platte subbasin, work has been concentrated largely on the comprehensive basin-wide report which is now about 90 percent complete. The work included preliminary geological reports on 10 reservoir sites, 1,200 miles of canal surveys, and semidetailed land classification on 2,140,000 acres.

Niobrara subbasin.—In the Niobrara subbasin, where little work had been done previous to this fiscal year, the principal activities have included preliminary surveys on dam sites and reservoirs, a start on agricultural surveys, reconnaissance, soils and topography surveys, preliminary canal surveys and water supply studies.

General.—At the close of fiscal year 1947, irrigation in region 7 reached a total of 211,000 acres. Approximately 200,000 acres were irrigated on the Bureau's North Platte project in Wyoming, 3,000 acres on the Kendrick project in Wyoming, and 8,000 acres on the Mirage Flats project in Nebraska. Supplemental water was delivered to the northern Colorado water conservancy district lands following initial diversion flow through the Alva B. Adams Tunnel and completion of the district's temporary diversion pipe leading this water into the Big Thompson River.

A high light of the year was the consummation of an electric service contract with the world-famous resort town of Estes Park, Colo. This contract was the first agreement to be signed covering the future delivery of power and energy to a municipality from the Colorado-Big Thompson project. Several similar agreements are now being negotiated with other municipalities in the area.

In the fiscal year just completed, the four hydro plants of region 7 generated 242,300,000 kilowatt-hours of electrical energy, a slight increase over the previous year. There were 235,200,000 kilowatt-hours of energy sold to municipalities, REA cooperatives, industrial plants, Army camps, and public utilities for a gross revenue of $1,557,000.

Division of Power

ARTHUR GOLDSCHMIDT, DIRECTOR

THE Division of Power is responsible for the general supervision and coordination of the power program of the Department. It assists in promoting the efficient operation of the power activities of the various agencies within the Department of the Interior. These activities are carried on by the Bureau of Reclamation, the Bonneville Power Administration, the Southwestern Power Administration, the Office of Indian Affairs, and the National Park Service.

The power program of the Department has grown as a result of recent installations of additional generators and because of the new responsibilities placed upon the Department by the Congress. As of June 30, 1947, the Bureau of Reclamation had 5,388,200 kilowatts of ultimate installed capacity either completed, under construction, or authorized for construction. This included completed installed capacity of 2,095,400 kilowatts and another 1,481,100 kilowatts under construction. The Flood Control Act of 1944 placed in the Secretary of the Interior the responsibility of transmitting and marketing all excess power generated at reservoir projects constructed by the Corps of Engineers of the War Department. These War Department power projects have an ultimate capacity of 8,726,200 kilowatts from completed plants, plants under construction, and projects which have been authorized for construction by the Congress. Of this amount, 623,400 kilowatts have been constructed, and plants totaling 1,510,000 kilowatts of initial capacity are under construction. At the end of the fiscal year, the Department of the Interior was marketing power from the largest aggregate of hydroelectric power in the world. In addition there are 93,000 kilowatts of generating capacity on Reclamation projects from which power is marketed by others—mostly project water users' organizations.

The Division of Power advises the Secretary on all power matters dealing with these hydroelectric installations and the transmission and sale of the energy generated. The problems involved include marketing studies and policies, rate studies, and review of the more important power contracts and the numerous problems arising from the handling of power in multiple-purpose developments. Power matters relating to the Department's administration in the Territories, including Alaska, Puerto Rico, and the Virgin Islands, are also handled by the Division.

Following the reduced power demand which prevailed throughout the greater part of fiscal year 1946, the weekly energy-output curve climbed sharply throughout fiscal year 1947, moving substantially above the wartime output in the week following Labor Day, and remaining above war outputs to the end of the fiscal year. The demand on the Department's system kept pace with the general demand throughout the country, especially in the Pacific Northwest and in Arizona, where peacetime production brought about higher power demands than had the full impact of the war. During the next fiscal year, it is expected that new peaks of power consumption will be reached, in some localities approaching the limits of capacity.

Power shortages in areas dependent in whole or in part on Department power systems were of major concern to the Division of Power and the power marketing agencies, and made necessary the resolution of policy and administrative problems involved in making provision for alleviating the shortages and for determining the basis by which the available power should be distributed to the best advantage. The Presidential proclamation of the end of hostilities, as of December 31, 1946, necessitated considerable nonrecurring work, as many of the wartime contracts had provided for termination within a certain time after the end of hostilities. The preparation of new contracts to take the place of the war agreements increased the work load of the Division.

War Department projects, subject to the power marketing provisions of the Flood Control Act of 1944, have been authorized in the Columbia Basin, in the Central Valley of California, in the Missouri Basin, in the Southwest and in the Southeast. In all except the Southeast, there are existing Department of Interior power marketing agencies, and these have been assigned the responsibility for marketing power from War Department projects in their respective areas—Bonneville Power Administration in the Columbia Basin; the Bureau of Reclamation in the Central Valley and the Missouri Basin; and the Southwestern Power Administration in the Southwest. In the absence of an established power marketing agency in the Southeast, the necessary preliminary work in connection with projects located in that area has been handled by the Division of Power.

The most imminent southeastern projects are in the Cumberland Basin in Kentucky and Tennessee, where the Dale Hollow, Wolf Creek, and Center Hill projects are under construction. Dale Hollow is due to be completed in the summer of 1948 and is scheduled to be followed by Center Hill and Wolf Creek at approximately 1-year intervals.

Because these projects are located adjacent to the power system of the Tennessee Valley Authority, it was determined by the Secretary of the Interior, upon the recommendation of the Division of Power, that arrangements be made with the TVA for the marketing of Cumberland River power. Negotiations were opened with the TVA and various methods of handling Cumberland power through the TVA were explored jointly. Agreement was reached on the general plan of making the total output of the plants available to TVA for handling in its system. Under this method, the cost of the power from the projects will be determined by the Department of Interior, and an agreement will be entered into between the Secretary of the Interior and the TVA, providing for the return of power costs of the projects to the Treasury. Preliminary cost studies have been completed by the Division of Power, and on February 10, 1947, the Secretary of the Interior transmitted to the Chairman of TVA a letter formalizing the understanding. This was accepted by TVA on March 5, 1947, thus permitting the TVA to proceed with the construction of transmission facilities necessary to tie the Cumberland projects into the TVA system, an undertaking which is expected to be sufficiently advanced to permit utilization of power from the projects by the time they are ready to produce.

Next to the Cumberland projects, the Allatoona project in the Coosa Basin near Atlanta, Ga., due to be completed about the end of 1949, is the most imminent problem facing the Division. Preliminary cost and allocation studies have been made of this project, discussions have been had with the War Department regarding design of electrical facilities and operations to meet the expected market requirements, and some market investigations have been made. Two other projects under construction in the Southeast are Clark Hill on the Savannah River, in South Carolina and Georgia, and Buggs Island on the Roanoke River, in Virginia and North Carolina. Preliminary cost studies have been made, and discussions with a few major potential customers have been undertaken in connection with these projects. Attention has also been given to other authorized and proposed projects in the Southeast area.

Following the end of the war, steps were taken to return the Grand River Dam project to the Grand River Dam Authority, an agency of the State of Oklahoma. This was completed on September 1, 1946, upon the passage of the necessary legislation in Public Law 573, Seventy-ninth Congress, second session. This dam had been taken over as an emergency war measure in 1941 and had been used for war purposes. Pending enactment of the congressional legislation, the Division of Power directed and participated in negotiations between the

Grand River Dam Authority and the Southwestern Power Administration, the agency which had been operating the dam since September 1, 1943. Rate studies of the Authority were also reviewed by the Division during the year.

Miscellaneous matters handled by the Division of Power during the year included review of a number of major rate studies and allocation and cost studies of the Department's power agencies, and participation in discussions with the Federal Power Commission relative to these rates. All important Interior power contracts were reviewed by the Division before final approval was given by the Secretary. Studies were made relative to the power shortage in Arizona, and of the proposed acquisition of the property of the Salt River Water Users' Association. The Columbia Basin report of the Bureau of Reclamation was reviewed and a report prepared for the Secretary. The Bureau's report on the Central Valley was reviewed, as was the pay-out studies for the basin. The Division aided the Southwestern Power Administration in its negotiations for the contemplated acquisition of the Ark-La transmission line. Studies were made of the Administration's plans to integrate with the facilities of the private utilities in the area and of its contract with the Texas Power & Light Co. The Division worked with the Bonneville Power Administration in connection with the phosphate development in Idaho, as well as in the negotiations of other major power load possibilities.

Active assistance was given to resolving the power situation in the Virgin Islands. A proposed contract for the purchase of surplus power from the Navy and other work in expediting the necessary tie with the Navy plant was prepared by the Division. The Division also worked with the Rural Electrification Administration on a financing plan for the St. Croix Authority of the Virgin Islands, and submitted a recommendation for the unification and change-over of the system. A study of the rates of the Puerto Rico Water Resources Authority was made by the Division, which also assisted in the negotiations whereby the Authority's interest in the oil storage tanks at San Juan were recognized in the disposal plan for those facilities. Studies of the power possibilities in Alaska were initiated, and conferences were held with representatives of the pulp and paper industries that are interested in this development.

Bonneville Power Administration

PAUL J. RAVER, ADMINISTRATOR

CONTINUING growth in power demands throughout the Pacific Northwest, accompanied by the necessity of virtual full-time operation of the generators of Bonneville and Grand Coulee Dams at overload conditions in order to keep abreast with the requirements for service in the area, marked fiscal year 1947 as one of the most critical in the 9-year history of the Bonneville Power Administration.

As the problem of meeting the power demands of the area became more acute, it became evident that only the continued, rapid installation of new generation at Grand Coulee Dam and at other dams authorized along the Columbia River and its tributaries, accompanied by the construction of transmission lines to handle the additional power, could bring relief to the region and permit its continued economic development.

As to the situation in the Pacific Northwest at the close of fiscal 1947, all installed generating capacity of the area—Federal, public, and private—was in full use and the area was facing a serious slowing down of the developmental march which has characterized the last few years, even though substantial amounts of new generating facilities are being installed at Grand Coulee Dam together with the transmission facilities required to take the power away from the dam. Since all technological development today is dependent on expansion of the energy base, further economic development of the Northwest can come only through the expansion of the region's energy base through construction of new dams on the Columbia River.

REVENUES

The fiscal year brought improvement in revenues of the Administration beyond that which had been anticipated a year ago. Higher returns from the aluminum industry and from publicly and privately owned utilities more than offset reductions in revenues from other categories such as shipyards and military establishments, which a year ago were still operating on a curtailed basis, but now are, for the most part, shut down. Total revenues from sales of Bonneville and Grand Coulee power by the Power Administration were $21,890,929, an increase of $2,008,114 over fiscal year 1946 and but $1,099,089 below the peak revenue year of 1945 at the height of the war program when the Power Administration had more power resources to draw upon because of the presence of two temporary generating units at Grand Coulee Dam, since removed to Shasta Dam in California. Total revenues since the beginning of power sales in 1939 reached $105,350,956, and the surplus, after deduction of all charges for operation, maintenance, depreciation, and interest, amounted to $22,933,144, of which $6,606,197 accrued during fiscal 1947. All revenues are returned to the Treasury of the United States, and the Administration depends entirely upon annual appropriations from Congress for money for operation, maintenance, and construction.

TABLE 1.—*Revenues by class of customers, fiscal years 1939–47*

Class of customer	1940 and prior	1941	1942	1943	1944
Industry:					
Aluminum		$1, 075, 809	$3, 770, 767	$7, 514, 122	$11, 989, 735
Other industry	$275	12, 899	243, 726	1, 284, 588	2, 976, 947
Military establishments		254	11, 860	182, 156	472, 789
Publicly owned utilities	12, 347	119, 659	411, 146	1, 230, 740	1, 994, 750
Privately owned utilities	413, 922	686, 882	882, 820	1, 767, 866	3, 401, 042
Other electric revenue		120	27, 692	41, 646	60, 665
Total operating revenue	426, 544	1, 895, 623	5, 348, 011	12, 021, 118	20, 895, 928

Class of customer	1945	1946	1947	Total to June 30, 1947	1947 percentage (dollars revenue)
Industry:					
Aluminum	$11, 838, 156	$7, 987, 226	$9, 045, 540	$53, 221, 355	41. 32
Other industry	3, 780, 727	2, 810, 662	1, 663, 122	12, 772, 946	7. 60
Military establishments	390, 742	298, 087	173, 227	1, 529, 115	. 79
Publicly owned utilities	2, 141, 635	1, 711, 822	2, 778, 765	10, 400, 864	12. 69
Privately owned utilities	4, 752, 021	5, 209, 344	6, 127, 669	23, 241, 566	27. 99
Other electric revenue	86, 737	[1] 1, 867, 144	[2] 2, 102, 606	4, 186, 610	9. 61
Total operating revenue	22, 990, 018	19, 884, 285	21, 890, 929	[3] 105, 352, 456	100. 00

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[1] This includes $1,789,443 of contract cancellations applicable to fiscal year 1946. (The total of $3,802,415 was apportioned over a period of 12 months.)

[2] This includes $2,012,972 of contract cancellations applicable to fiscal year 1947. (The total of $3,802,415 was apportioned over a period of 12 months.)

[3] As of June 30, 1947, the Administration had collected and deposited in the United States Treasury power revenue receipts totaling $95,392,102, and general fund receipts of $4,602,791. Accounts receivable, accrued unbilled revenues, unbilled exchange power sales, miscellaneous adjustments, and minor items account for the difference between total revenues and total receipts deposited with the United States Treasury.

ENERGY PRODUCTION

A total of 8,753,737,320 kilowatt-hours of energy was produced by the Bonneville and Grand Coulee plants during the year, just slightly below the peak year of 1944, when energy production reached 9,239,823,452 kilowatt-hours. Energy losses due to transmission were somewhat lower than during fiscal 1946 with Power Administration deliveries to customers and for other purposes totaling 8,457,971,299, or 6.4 percent less than actual energy production by the two plants. Table 2, generation at Bonneville and Grand Coulee Dams, shows energy production from the beginning of operations to the end of fiscal 1947, while table 3, electric energy account, presents in detail the explanation of energy received and energy delivered by the Administration.

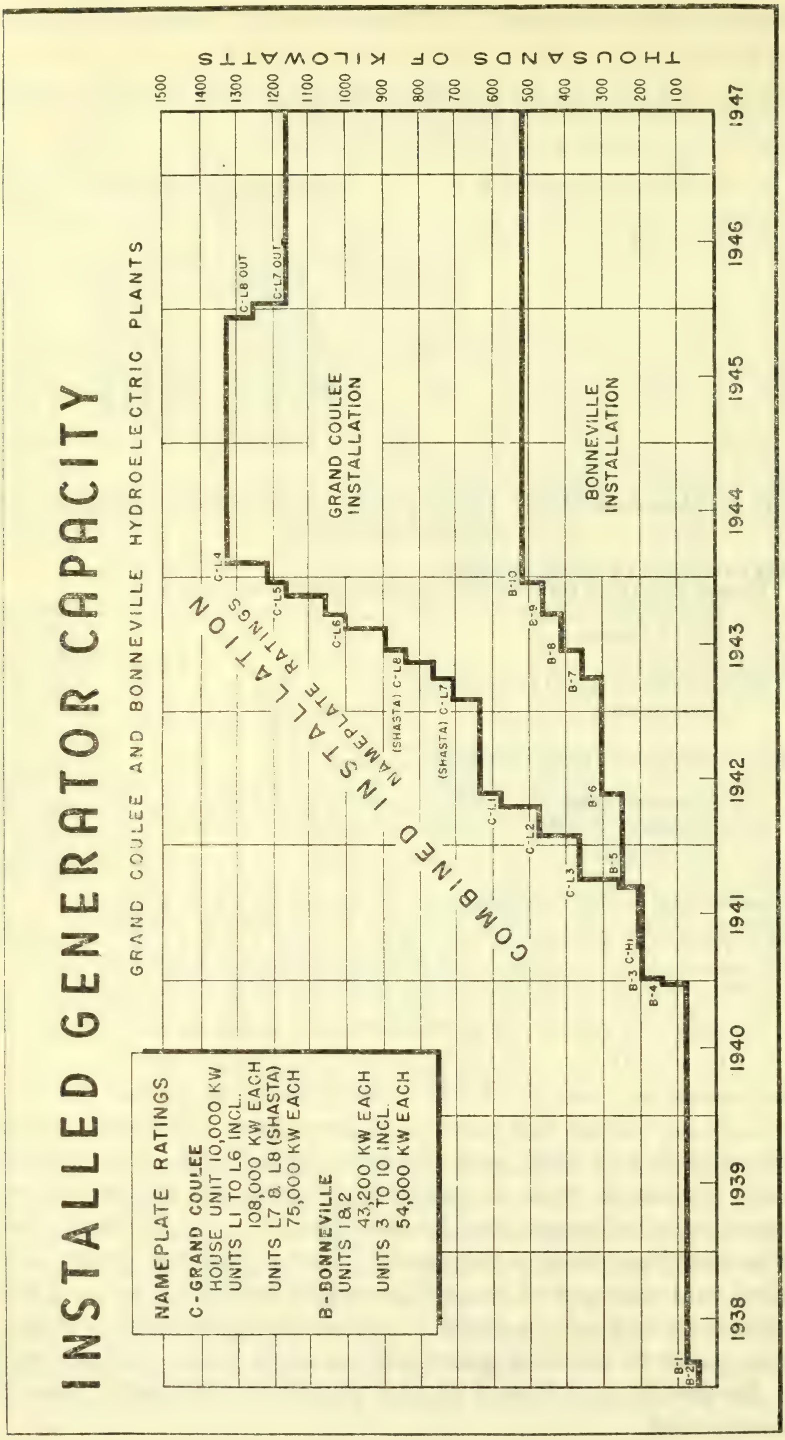
TABLE 2.—*Bonneville Power Administration generation at Bonneville and Grand Coulee plants, 1938–47*

Fiscal years ending June 30	Bonneville Dam generation	Grand Coulee Dam generation	Total generation for Bonneville Power Administration
	Kilowatt-hours	*Kilowatt-hours*	*Kilowatt-hours*
1939	34, 874, 138		34, 874, 138
1940	208, 426, 077		208, 426, 077
1941	894, 177, 000	7, 455, 000	901, 632, 000
1942	1, 807, 309, 000	741, 844, 249	2, 549, 153, 249
1943	2, 801, 480, 400	2, 816, 955, 729	5, 618, 436, 129
1944	3, 488, 873, 992	5, 750, 949, 460	9, 239, 823, 452
1945	3, 391, 127, 400	5, 660, 445, 960	9, 051, 573, 360
1946	2, 674, 834, 000	3, 561, 329, 280	6, 236, 163, 280
1947	3, 695, 255, 000	5, 058, 482, 320	8, 753, 737, 320
Total	18, 996, 357, 007	23, 597, 461, 998	42, 593, 819, 005

TABLE 3.—*Bonneville Power Administration electric energy account, fiscal year ended June 30, 1947.*

Energy received (kilowatt-hours):	
Energy generated for Bonneville Power Administration:	
Bonneville	3, 695, 255, 000
Grand Coulee	5, 058, 482, 320
Total	8, 753, 737, 320
Power purchased and interchanged in	281, 206, 225
Total received	9, 034, 943, 545
Energy delivered (kilowatt-hours):	
Sales	8, 235, 678. 873
Power interchanged out	209, 099, 540
Used by administration	13, 192, 816
Total delivered	8, 457, 971, 229
Energy losses	576, 972, 316
Percent of total energy received	6. 4
Maximum demand on Bonneville and Grand Coulee plants (kilowatt), Feb. 24, 1947, 11–12 a. m	1, 335, 000
Load factor—total generated for Bonneville Power Administration	74. 9

The year did not bring new generating capacity at Bonneville or Grand Coulee Dams. Removal of the two Shasta generators left the Administration with 150,000 kilowatts less capacity than during the war. It is expected that additional generation will become available in the late fall of 1947, with the installation of the seventh regular Coulee generator with a name-plate rating of 108,000 kilowatts. Present installed capacity at the two plants is now 1,176,400 kilowatts, but necessity has made it mandatory that the plant equipment be overloaded, and they are at present normally producing up to 1,335,000 kilowatts during peak periods. The accompanying graph shows the development in installed generator capacity (name-plate rating) at the Bonneville and Grand Coulee plants for the fiscal years 1938 through 1946.



INSTALLED GENERATOR CAPACITY

GRAND COULEE AND BONNEVILLE HYDROELECTRIC PLANTS

ENERGY DELIVERIES

During the 9 years of the Bonneville Power Administration's life, the Administration's system delivered 40,045,883,000 kilowatt-hours of energy, of which 8,235,679,000 kilowatt-hours represent the sales during the last fiscal year. Table 4, electric energy sales by class of customer, shows energy deliveries since the beginning of Administration sales.

The yearly system peak occurred on February 24, 1947, during the hour 11 a. m., to 12 noon, when the demand reached 1,335,000 kilowatts. This exceeded the rated generating capacity of 1,176,000 kilowatts by 13.5 percent. The maximum demand in all months from October 1946 through June 1947 exceeded the rated generating capacity, with the demand in 7 of the months exceeding 1,300,000 kilowatts. The annual load factor of energy generated during the fiscal year was 74.9 percent.

During the fiscal year the Administration served 89 wholesale customers, of which 54 were publicly owned utilities, 6 were privately owned utilities, 11 were military establishments, and 18 were industries. Service was added for seven new customers, all publicly owned utilities, and discontinued for six customers, all military establishments and industries. Twelve additional delivery points were established and one discontinued for existing customers. Service was continued to four large aluminum reduction and fabricating plants which resumed full operations after a change in ownership following the war. Table 5 shows Bonneville Power Administration energy deliveries to customers during fiscal 1947.

TABLE 4.—*Electric energy sales by class of customer,*[1] *fiscal years 1939–47*

[Kilowatt-hours]

Class of customer	1939	1940	1941	1942	1943	1944	1945	1946	1947	Total to June 30, 1947
Industry:										
Aluminum	--------	--------	522, 982	1, 845, 249	3, 588, 848	5, 453, 893	4, 667, 381	2, 538, 590	4, 253, 316	22, 870, 259
Other industry	--------	21	4, 790	76, 580	464, 309	934, 588	878, 896	693, 795	551, 311	3, 604, 290
Military establishments	--------	--------	18	2, 575	42, 887	87, 889	85, 828	59, 970	26, 557	305, 724
Publicly owned utilities	7	3, 101	32, 134	142, 491	435, 289	727, 642	823, 817	635, 284	1, 026, 188	3, 825, 953
Privately owned utilities	30, 036	188, 896	317, 713	357, 704	739, 076	1, 467, 304	2, 057, 203	1, 903, 508	2, 378, 307	9, 439, 657
Total	30, 043	191, 928	877, 637	2, 424, 599	5, 270, 409	8, 671, 316	8, 513, 125	5, 831, 147	8, 235, 679	40, 045, 883

[1] Includes sales under exchange agreements.

'ABLE 5.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1947*

DELIVERIES UNDER POWER CONTRACTS

	Energy deliveries for year	Date of initial service
'ublicly owned utilities:		
Municipalities:		
Bandon, Oreg	276. 096	February 1947.
Canby, Oreg	3. 408. 000	February 1940.
Cascade Locks, Oreg	2. 988. 200	March 1939.
Centralia, Wash	37. 000	January 1941.
Drain, Oreg	2. 553. 600	April 1941.
Ellensburg, Wash	14. 401. 600	May 1941
Eugene, Oreg	33. 607. 000	August 1946
Forest Grove, Oreg	11. 166. 400	December 1939
Grand Coulee, Wash	9. 013. 200	January 1942
McMinnville, Oreg	25. 710. 000	October 1940
Milton, Oreg	3. 031. 200	June 1946
Monmouth, Oreg	3. 348. 800	December 1940
Total municipalities	109. 491. 096	
Public utility districts:		
Central Lincoln Peoples' utility district	12. 516. 912	
Toledo		October 1946
North Bend		February 1947
Clark County public utility district No. 1	102. 279. 527	
City limits		May 1946.
Mill plain		September 1942.
Vancouver shipyard		May 1946.
Clatskanie Peoples' utility district	2. 186. 718	March 1943.
Cowlitz County public utility district No. 1	211. 386. 464	August 1941.
Douglas County public utility district No. 1	3. 936. 500	August 1946.
Grant County public utility district No. 2	29. 191. 514	
Soap Lake		August 1942.
Coulee City		August 1942.
Construction Load		September 1946.
Moses Lake		October 1946.
Stratford		October 1946.
Ephrata		March 1947.
Grays Harbor public utility district No. 1	82, 585, 000	November 1940.
Kittitas County public utility district No. 1	2, 007, 360	June 1941.
Klickitat County public utility district No. 1	1, 209, 940	November 1940.
Lewis County public utility district No. 1	9, 292, 200	
Mossyrock		May 1941.
Elbe		October 1945.
Okanogan County public utility district No. 1	41, 135, 765	August 1946.
Pacific County public utility district No. 2	25, 427, 422	
Raymond		October 1940.
Naselle		November 1940.
Skamania County public utility district No. 1	5, 965, 530	
Stevenson		January 1940.
White Salmon		April 1942.
Bonneville Dam		January 1943.
Tillamook County peoples' utility district	106, 800	October 1946.
Wahkiakum County public utility district No. 1	5, 020, 200	
Cathlamet		November 1940.
Svenson		Do.
Total public utility districts	534, 247, 852	
Cooperatives:		
Benton-Lincoln Electric Cooperative	7, 107, 350	
Albany		October 1940.
Harrisburg		May 1946.
Logsden		February 1947.
Wren		April 1947.
Benton Rural Electric Association	6, 925, 560	
Porsser		July 1942.
Grandview		Do.
Big Bend Electric Cooperative	2, 819, 782	
Ritzville		August 1942.
Delight		Auugst 1945.
Blachly-Lane Electric Cooperative	1, 119, 750	September 1945.
Clearwater Valley Light & Power Association	7, 159, 800	
Juliaetta		August 1942.
Irofino		April 1947.
Columbia County Rural Electric Association	4, 465, 200	July 1941.
Coos-Curry Electric Cooperative	915, 600	February 1947.
Douglas Electric Cooperative	5, 029. 125	
Brockway Junction		September 1941.
Drain		June 1946.
Krewson		October 1946.

TABLE 5.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1947*—Continued

DELIVERIES UNDER POWER CONTRACTS—Continued

	Energy deliveries for year	Date of initial service
Publicly owned utilities—Continued		
Cooperatives—Continued		
Hood River Electric Cooperative	2, 970, 340	May 1946.
Idaho County Light and Power Cooperative Association	1, 272, 500	August 1942.
Inland Empire Rural Electric Association	17, 432, 350	
Colfax		August 1942.
Geiger		June 1946.
Pullman		July 1946.
Spring Valley		June 1946.
St. John		Do.
Valley Way		Do.
Kootenai County Rural Electric Association	2, 705, 990	
Coeur d'Alene		August 1942.
Harrison Flats		Do.
Lane County Electric Cooperative	2, 675, 560	
Lincoln Electric Cooperative	4, 712, 400	
Davenport		April 1942.
Almira		Do.
Nespelem Valley Electric Cooperative	2, 014, 740	September 1941.
Northern Idaho Rural Electrical Rehabilitation Association	2, 220, 240	May 1943.
Okanogan County Electric Cooperative	1, 002, 480	August 1942.
Pend Oreille Electric Cooperative	1, 176, 120	May 1943.
Salem Electric	11, 858, 753	
West		March 1941.
North		October 1945.
Stevens County Electric Cooperative	5, 105, 435	
Addy		August 1942.
Evans		Do.
Umatilla Electric Cooperative	5, 864, 202	
Substation		July 1942.
Depot		February 1943.
Wasco Electric Cooperative	3, 226, 200	May 1941.
West Oregon Electric Cooperative	2, 243, 664	
Olney		February 1941.
Vernonia		October 1946.
Total cooperatives	102, 023, 141	
Other:		
Oregon State College	1, 377, 603	November 1946.
Vera irrigation district No. 15	5, 994, 800	December 1945.
Total publicly owned utilities	753, 134, 492	
Privately owned utilities:		
Mountain States Power Co	13, 244, 254	August 1943.
Pacific Power and Light Co	42, 594, 478	June 1941.
Portland General Electric Co	1, 052, 505, 358	December 1939.
Puget Sound Power and Light Co	1, 010, 833, 000	October 1943.
WWP-PP&L Companies	139, 180, 000	
Total privately owned utilities	2, 258, 357, 090	
Military Establishments (11)	26, 556, 945	
Industries:		
Aluminum:		
Aluminum Co. of America	1, 498, 335, 000	September 1940.
Permanente Metals Co.:		
Spokane Aluminum Fabricating	[1] 182, 260, 000	December 1942.
Spokane Aluminum Reduction	[1] 1, 226, 848, 000	May 1942.
Tacoma Aluminum Reduction	[1] 850, 000	August 1942.
RFC-Salem Alumina	48, 673, 000	July 1945.
Reynolds Metals Co.:		
Longview	523, 990, 000	August 1941.
Troutdale	[1] 772, 360, 400	May 1942.
Total aluminum plants	4, 253, 316, 400	
Other industries (11)	551, 310, 394	
Total industries	4, 804, 626, 794	
Total deliveries under power contracts	7, 842, 675, 321	

[1] Includes all energy deliveries to plant with change in ownership.

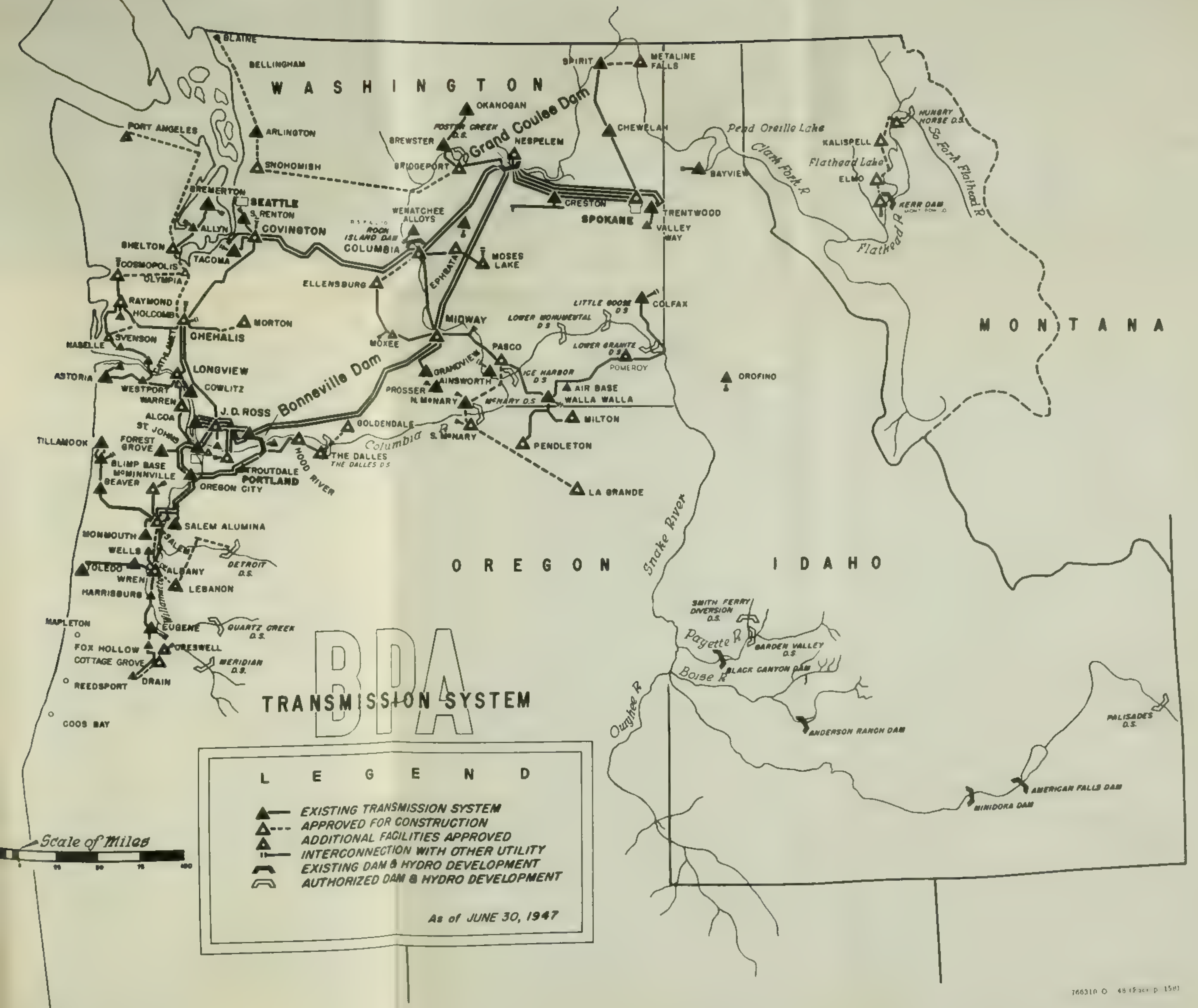

BPA
TRANSMISSION SYSTEM
LEGEND
EXISTING TRANSMISSION SYSTEM
APPROVED FOR CONSTRUCTION
ADDITIONAL FACILITIES APPROVED
INTERCONNECTION WITH OTHER UTILITY
EXISTING DAM & HYDRO DEVELOPMENT
AUTHORIZED DAM & HYDRO DEVELOPMENT
As of JUNE 30, 1947
Scale of Miles
0
25
50
75
100
WASHINGTON
OREGON
IDAHO
MONTANA
Grand Coulee Dam
Bonneville Dam
BLAINE
BELLINGHAM
PORT ANGELES
ARLINGTON
SNOHOMISH
BREMERTON
SEATTLE
S. RENTON
ALLYN
COVINGTON
SHELTON
TACOMA
COSMOPOLIS
OLYMPIA
RAYMOND
HOLCOMB
SVENSON
NASELLE
CHEHALIS
MORTON
ASTORIA
WESTPORT
LONGVIEW
COWLITZ
WARREN
ALCOA
ST JOHNS
J. D. ROSS
TILLAMOOK
FOREST GROVE
BLIMP BASE
McMINNVILLE
BEAVER
TROUTDALE
PORTLAND
OREGON CITY
HOOD RIVER
SALEM ALUMINA
MONMOUTH
WELLS
SALEM
TOLEDO
ALBANY
WREN
HARRISBURG
LEBANON
DETROIT D.S.
Willamette R
MAPLETON
EUGENE
QUARTZ CREEK D.S.
FOX HOLLOW
CRESWELL
COTTAGE GROVE
MERIDIAN D.S.
DRAIN
REEDSPORT
COOS BAY
OKANOGAN
FOSTER CREEK D.S.
BREWSTER
NESPELEM
BRIDGEPORT
WENATCHEE ALLOYS
ROCK ISLAND DAM
COLUMBIA
EPHRATA
MOSES LAKE
ELLENSBURG
MOXEE
MIDWAY
GRANDVIEW
PASCO
PROSSER
AINSWORTH
N. McNARY
McNARY D.S.
ICE HARBOR D.S.
GOLDENDALE
THE DALLES
THE DALLES D.S.
Columbia R
S. McNARY
PENDLETON
LA GRANDE
AIR BASE
WALLA WALLA
MILTON
POMEROY
LOWER GRANITE D.S.
LOWER MONUMENTAL D.S.
LITTLE GOOSE D.S.
COLFAX
SPIRIT
METALINE FALLS
CHEWELAH
CRESTON
SPOKANE
TRENTWOOD
VALLEY WAY
BAYVIEW
Pend Oreille Lake
Clark Fork R
OROFINO
Snake River
KALISPELL
HUNGRY HORSE D.S.
So Fork Flathead R
Flathead Lake
ELMO
KERR DAM
MONT. POW. CO.
Flathead R
SMITH FERRY DIVERSION D.S.
Payette R
GARDEN VALLEY D.S.
BLACK CANYON DAM
Boise R
Owyhee R
ANDERSON RANCH DAM
PALISADES D.S.
AMERICAN FALLS DAM
MINIDOKA DAM

TABLE 5.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1947*—Continued

DELIVERIES UNDER EXCHANGE AGREEMENTS

	Energy deliveries for year	Date of initial service
Publicly owned utilities:		
Eugene, Oreg.	322,000	
Seattle, Wash.	193,983,000	
Tacoma, Wash.	78,749,000	
Total publicly owned utilities	273,054,000	
Privately owned utilities:		
California-Oregon Power Co.	24,764,000	
Mountain States Power Co.	6,000	
Pacific Power & Light Co.	9,418,522	
WWP-PP&L companies	85,761,030	
Total privately owned utilities	119,949,552	
Total exchange	393,003,552	
Total energy sales under power contracts and exchange	8,235,678,873	

TRANSMISSION SYSTEM

At the end of fiscal year 1947, Bonneville Power Administration had in operation 3,021 circuit miles of transmission lines and 72 substations and switching stations. The transmission system consisted of 1,318 circuit miles of 230-kilovolt lines, 1,310 circuit miles of 115-kilovolt lines and 393 circuit miles of lower voltages.

A total of 202.3 circuit miles of transmission lines of all types were placed in service during the fiscal year. This included 30.5 circuit miles of 230-kilovolt lines, 167.7 circuit miles of 115-kilovolt lines, and 4.1 circuit miles of lower voltage line.

Among the important construction jobs of the fiscal year was the completion and placing in service in January 1947 of 30.5 miles of 230-kilovolt lines between Grand Coulee and Foster Creek, a portion of the ultimate 230-kilovolt line between Grand Coulee and Snohomish, Wash. In connection with this line, the 115-kilovolt line between Foster Creek and Brewster, 13.9 circuit miles, was also completed and placed in service in January 1947. With the purchase of the Brewster-Okanogan 115-kilovolt line, 21.4 circuit miles, in May 1947, direct service is now supplied to distributors in north central Washington.

Other major additions to the 115-kilovolt system include the Albany-Toledo line of 41.9 miles in length, which was completed and placed in service in October 1946. Due to difficulties encountered by the contractor for this line, it was necessary for Bonneville Power Administration construction crews to assist in the completion of the line. This line is the first step in meeting the critical power shortage in the southern Oregon coastal area.

The Ephrata-Moses Lake 115-kilovolt line, 19.5 circuit miles, was completed and placed in service in March 1947, and the Midway-Grandview 115-kilovolt line, 25.1 circuit miles, was completed and placed in service in May 1947. Both these lines supply areas where power shortages existed.

The total substation transformer capacity on June 30, 1947, was 2,360,000 kilovolt-amperes, a net increase of 29,000 kilovolt-amperes over the figure for the preceding year. Actual installation totaled 125,300 kilovolt-amperes, and 96,050 kilovolt-amperes capacity was removed or replaced with larger transformers. Table 6 summarizes the Bonneville Power Administration system additions for the fiscal year.

TABLE 6.—*Bonneville Power Administration system additions*

	Circuit miles			
	230 kilovolts	115 kilovolts	Under 115 kilovolts	Total
Transmission lines:				
Placed in operation 1947 fiscal year	30.5	167.7	4.1	202.3
Removed from operation 1947 fiscal year			31.1	31.1
In operation June 30, 1946	1,287.2	1,142.3	409.9	2,839.4
Total operated June 30, 1947	1,317.7	1,310.0	382.9	3,010.6
Leased to others			10.3	10.3
Grand total June 30, 1947	1,317.7	1,310.0	393.2	3,020.9

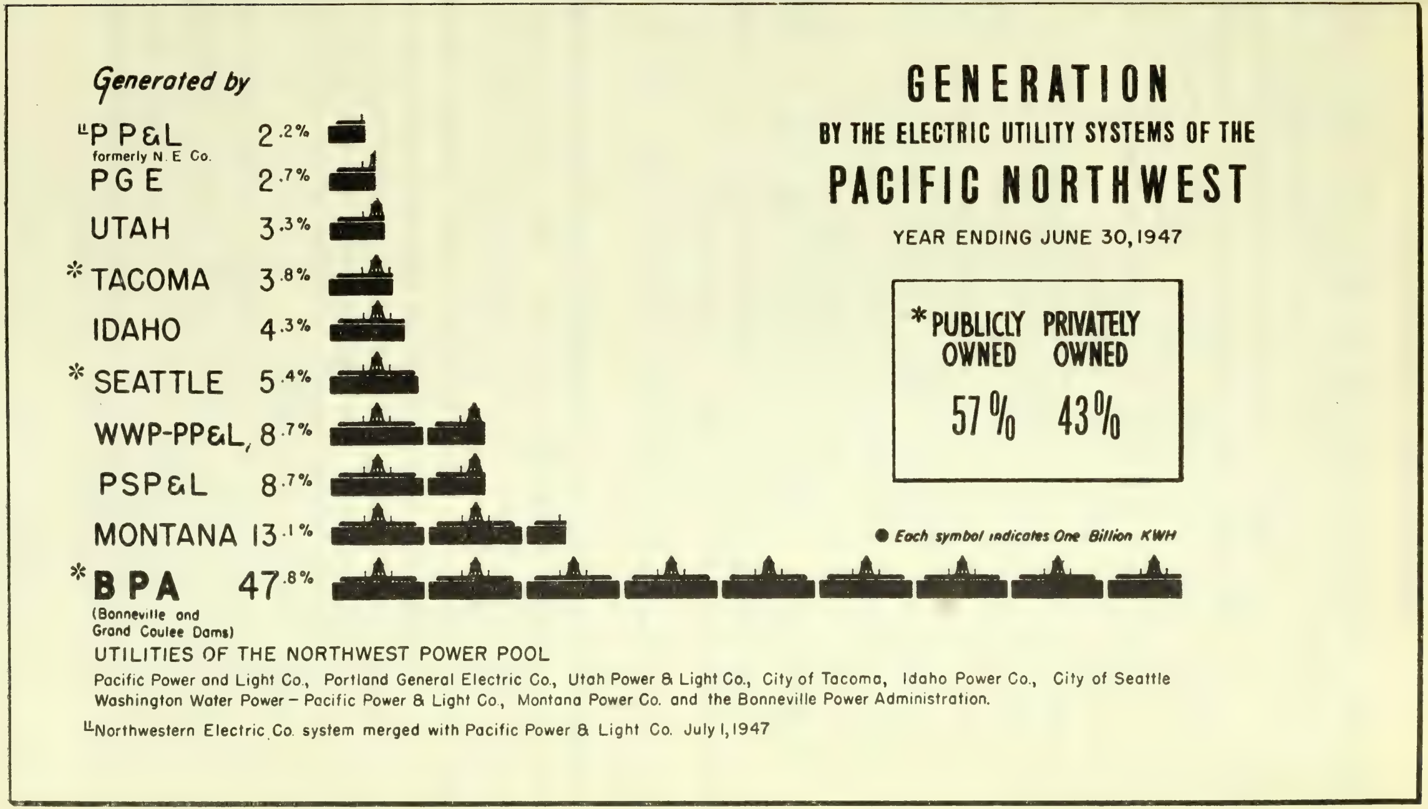
	Installed at end of 1946 fiscal year	Fiscal year 1947		Installed at end of 1947 fiscal year
		Added	Removed	
Substation facilities operated:				
Transformation kilovolt-ampere	[1] 2,330,633	125,300	96,050	[1] 2,359,883
Static condensers do	59,110			59,110
Synchronous condensers do	287,500			287,500
Substations Number	[2] 50	15	6	[2] 59
Switching stations do	12	2	1	13

[1] All transformers in service. No allowance for temporary added capacity with portable fans. Includes 600 kilovolt-amperes owned, but operated by others.

[2] Includes one 600-kilovolt-ampere substation owned, but operated by others.

As during the preceding year, shortages of materials, uncertainty of material deliveries, and the consequent necessity for changing plans and designs continued to delay construction progress. Material shortages and delays in delivery were particularly severe in connection with poles, line material, and power transformers. However, in the majority of cases, the Administration was able to meet the requirements of customers in a rapidly expanding power market.

With the exception of the unprecedented increase in loads, no operating problems of note developed during the year. In spite of the increase in loads, some progress was made toward reducing a large backlog of maintenance and repair work which accumulated during the war years.



GENERATION

BY THE ELECTRIC UTILITY SYSTEMS OF THE

PACIFIC NORTHWEST

YEAR ENDING JUNE 30, 1947

● Each symbol indicates One Billion KWH

UTILITIES OF THE NORTHWEST POWER POOL

Pacific Power and Light Co., Portland General Electric Co., Utah Power & Light Co., City of Tacoma, Idaho Power Co., City of Seattle Washington Water Power – Pacific Power & Light Co., Montana Power Co. and the Bonneville Power Administration.

ᴸNorthwestern Electric Co. system merged with Pacific Power & Light Co. July 1, 1947

WHOLESALE POWER RATES

The basic wholesale rate structure for Bonneville-Grand Coulee power establishes $17.50 per kilowatt-year as the price of power delivered anywhere on the transmission system. (At the power plants, for power to be used within 15 miles of them, the rate is $14.50 per kilowatt-year.) This basic rate is incorporated in the Bonneville Power Administration's C schedule. Several optional rates, all consistent with the $17.50 rate, are available to customers. Dump and excess energy and energy delivered for experimental purposes is sold under schedule H at 2.5 mills per kilowatt-hour.

The basic kilowatt-year rate has been particularly effective in encouraging growth of industries using electricity at a high load factor and in such quantities as to make power an important item in their costs of manufacture. Several new wholesale power rates and rate provisions consistent with the $17.50 per kilowatt-year rate, have been developed pursuant to studies on postwar industrial development and on availability of power on the Bonneville-Grand Coulee system.

A revised set of wholesale rates, including schedules A–5, C–5, E–4, F–4 and general rate schedule provisions, and new rates, including schedule R–1 and S–1, have been filed with the Federal Power Commission and are awaiting approval. Schedule R–1 applies to railroad electrification with a rate of 4 mills per kilowatt-hour. This rate is based on the load characteristics for this type of load as related to availability of power on the Bonneville system and to the system load curve.

Schedule S–1 covers the sale of secondary energy not continuously available at a rate of 1 mill per kilowatt-hour. This rate was designed to market a limited quantity of byproduct power, to make such power available in the most advantageous manner in the development of the region, and yet to provide a maximum of revenue. It covers energy to be used in industrial processes which can shut down operations for limited periods without serious effect on employment or on the economy of the community, and is restricted to purchasers of firm power or to purchasers who maintain standby facilities which can be used when secondary energy is not available.

A new wholesale rate provision for irrigation service was incorporated in the E schedule. This provision establishes a seasonal maximum charge of $6 per kilowatt for power used during the months May through September of each year. This rate was fixed as low as possible, recognizing the character of the power to be supplied and all favorable factors, but avoiding subsidy for irrigation.

UTILIZATION ACTIVITIES

During fiscal year 1947, the Administration continued, by means of its utilization program to the extent funds were available, to assist power distributors in their market-development activities. Due to the generally prevalent power-shortage condition throughout the region, the major emphasis of the utilization work was not directed to current-load building, but rather to assisting Columbia River power distributors in establishing a firm base for future promotional efforts, so that when feasible from the standpoint of power supply, they could emerge with full-scale and effective sales campaigns.

An important part of this groundwork consisted of a series of "Customer opinion and market surveys" in cooperation with distributors. These surveys provide a valuable guide to distributors in formulating their future utilization plans and programs, and are also helpful to the Administration in load forecasting. In addition, they provide distributors with information which is useful in redesigning and expanding their distribution systems to serve present and future loads. Sixteen of these surveys were completed during the year.

The small staff of utilization experts in the Bonneville Power Administration was kept active in working out various sales problems upon which distributors requested advice, and assisted in training distributors' personnel in utilization activities.

The Bonneville Power Administration participated in many dealer meetings, cooking schools, group demonstrations, appliance exhibits, and other activities throughout the area which were designed to strengthen the market for nonindustrial uses of electric power.

Throughout the year, intensive efforts were devoted to investigations and studies of electric house heating to determine the feasibility and economics of electric space heating as an outlet for hydroelectric power. The advisability of adopting minimum building and equipment specifications covering the use of electric heating was stressed to power distributors, building contractors, heating and ventilating engineers, and the public in general. These specifications establish minimum requirements for installation, weather stripping, automatic controls, and general approval of various types of heating equipment. The objective is to obtain uniform standards throughout the Northwest which would safeguard against inadequate equipment and installations which might result in high heating costs to the consumer and high demands on the power systems.

COOPERATIVE RESEARCH PROGRAM

Throughout the year, the Administration continued its cooperative research program. Under this program, the Administration and various colleges and universities of the Pacific Northwest jointly undertake and finance research on projects of importance to the region from a power standpoint. Three new projects were inaugurated during the year and six existing projects were supplemented with additional funds. Two of the new projects were concerned with the treatment of foods for blanching, defrosting, and sterilization by high-frequency electric current, and the other new project covered an investigation of methods of using electricity in the manufacture of charcoal from wood waste. Three of the projects given additional funds were on various aspects of electric space heating and the others concerned methods of farm drying of cranberries, sprinkler irrigation, and electric welding on the farm. In addition to the projects mentioned above, work on projects initiated in prior years continued satisfactorily.

At the present time, six institutions are participating in the Bonneville Power Administration's cooperative research program, namely, Oregon State College, the State College of Washington, the University of Washington, Montana State College, Pacific University, and Linfield College.

PERSONNEL

The personnel of the Administration, including those on leave without pay, on June 30, 1947, totaled 2,076. During the year these employees made 178 suggestions to the Department of the Interior Beneficial Suggestion Awards Committee, and 13 employees received awards totalling $715 for suggestions as to ways of improving the efficiency of the service.

A conscious effort was made to reward efficient work through within-grade advancements for superior accomplishment, a total of 21 increases having been given.

Improvement of employee-supervisory relations was continued through addition of cooperative committees for the purpose of reviewing the efficiency rating appeals and by the cooperative development of a new efficiency rating system for the hourly employees. Under the collective agreement employee-supervisor committees developed rules governing working conditions for the electrical workers, which were incorporated within the collective agreement by joint action of the Columbia Power Trades Council and the Bonneville Power Administration. Similar rules were initiated for the machinists.

Uncertainties as to congressional appropriations and program for the fiscal year 1948 were reflected in material loss of morale during the latter part of fiscal 1947. The first set of cuts required under congressional action was planned in advance and executed on the basis of action of the Senate before final decision by both houses of Congress in conference. This led to a reduction of working employees by 200, and a physical transfer of twice as many employees to new jobs within the Administration in order to comply with civil service reduction-in-force procedures. Subsequently, when final appropriation figures became known it was necessary to make further personnel reductions, for the most part in the administrative, operations and maintenance organizations, bringing the total reduction in force down from 2,076 to 1,653 and requiring a physical transfer of some 1,200 persons to new positions within the Administration in order to meet reduction-in-force procedures.

A service-wide classification survey was begun and tentative results reached before the reductions in force began, but because of the large number of reassignments required during these reductions the results were not put into effect except for positions which were vacated as a result of reductions in force.

The Administration again won the first award of the Portland Safety Traffic Commission in the Government Division; and the Bonneville Project Associates, an employee welfare organization, again won the grand sweepstakes in the noncommercial division of the Portland Rose Festival parade.

THE POWER SUPPLY PROBLEM

As the past year progressed the seriousness of the power supply situation in the Pacific Northwest region became more and more apparent. The rapid return to operation of aluminum plants, which were temporarily shut down following the war, the growing demand of new and expanded industries and for commercial and domestic power on the systems of the region's distributors, the fact that for the most part generating capacity in the area has remained static since the war, combined to present a problem of considerable magnitude. The situation was somewhat relieved by the temporary shut-downs in the spring of 1947 of the Reynolds Metals Co., aluminum ingot plant at Longview, Wash., releasing some 66,000 kilowatts. It is expected, however, that the plant will resume operations early in 1948.

Including the Bonneville Power Administration, the Pacific Northwest power pool has some 3,561,000 kilowatts of available capacity, exclusive of a few smaller plants which would bring the total for the area to approximately 3,700,000 kilowatts. Of pool capacity, 2,853,000 kilowatts is represented in the western division—the Bonneville Power

Administration, Washington Water Power Co., Portland General Electric Co., Pacific Power & Light Co., Puget Sound Power & Light Co., and the Seattle and Tacoma, Wash., city light plants. The remainder in the eastern division represents the generating capability of the Montana Power Co., Idaho Power Co., and Utah Power Co. Table 7 represents actual generation by the electric utility systems of the Pacific Northwest interconnected systems for fiscal 1947.

TABLE 7.—*Actual generation by the electric utility systems of the Pacific Northwest interconnected systems fiscal year 1947*

Utilities	Billions of kilowatt-hours	Percent of total generation
Publicly owned:		
Bonneville Power Administration	8.8	47.8
Seattle city light system	1.0	5.4
Tacoma city light system	.7	3.8
Total publicly owned	10.5	57.0
Privately owned:		
Puget Sound Power & Light Co	1.6	8.7
Washington-Pacific System	1.6	8.7
Northwestern Electric Co.[1]	.4	2.2
Portland General Electric Co	.5	2.7
Montana Powder Co	2.4	13.1
Utah Power & Light Co	.6	3.3
Idaho Power Co	.8	4.3
Total privately owned	7.9	43.0
Total Northwest interconnected systems	18.4	100.0

[1] Northwestern Electric Co. and Pacific Power & Light Co. were merged July 1, 1947, and are now known as Pacific Power & Light Co.

FUTURE POWER REQUIREMENTS

With the Pacific Northwest power pool peak reaching a then new high of 3,220,000 kilowatts last December, of which 2,587,000 kilowatts was in the western division, and with an anticipated peak of 2,947,000 kilowatts expected in December of 1947, western division members met at Tacoma, Wash., in January to draft a schedule of power requirements for the period running through 1953.

This schedule showed that new Federal generating capacity in the amount of 318,000 kilowatts, over and above the 745,000 kilowatts of generating units now being installed or on order for Grand Coulee Dam, would be required before November 1949 to meet the critical power supply problem, and that an additional 1,565,000 kilowatts would be required by November 1953. In other words, the utilities of the western division of the power pool agreed that the generating capacity in their area must be doubled by late 1953 if the Pacific Northwest is not to be penalized in its economic expansion.

Pointing out that provision for future supplies of electric power adequate to maintain continued industrial, agricultural and utility development in the Pacific Northwest depends upon the construction of multiple-purpose projects on the Columbia River and its tributaries, and that "the Federal Government, by numerous acts of Congress had assumed the responsibility for the construction of the projects," the pool members urged that "the necessary appropriations be made available as rapidly as possible" to keep the program moving forward. They further urged that "inasmuch as these Federal generating plants are located a considerable distance from the region's load centers," and "inasmuch as present transmission facilities of the Bonneville Power Administration are already approaching conditions of full load, essential appropriations for backbone transmission facilities be made available to the Administration on an annual and continuing basis to provide means for the delivery of power to load centers."

The Northwest Public Power Association, representing operating publicly owned utilities in the region, at a meeting shortly after the Tacoma conference, endorsed the pool agreement, but supplemented it as follows:

> The statement of policy regarding transmission line construction adopted by the Northwest power pool in our judgment fails to give full consideration to the problems and rights of the 34 municipal power systems, 19 public utility districts, and 40 electric cooperative associations presently operating in this area, which, by congressional enactment, are given a preferred status in the purchase of Columbia River power.
>
> These cooperative and nonprofit systems serving a large number of the people of Idaho, Montana, Oregon, and Washington, have undertaken to distribute hydroelectric energy from the Federal projects under a specific congressional policy, making the benefits of these developments available to all consumers within economic transmission distance. To avoid the monopolization of power from Grand Coulee and Bonneville Dams, Congress has enacted legislation and appropriated funds for the construction of transmission lines to serve not only "major" load centers, but smaller municipalities and rural areas as well.
>
> As a matter of justice, the fulfillment of this congressional policy, and the recognition of the equal rights of smaller business enterprises and farm groups to share in the benefits of the Federal development, require the correlated construction of such transmission lines other than "backbone" lines, as are economic units of the Federal transmission system, for which the Government will be fully reimbursed under existing wholesale rates.

THE SOLUTION

In order to meet this situation, continued and uninterrupted construction of new facilities should be undertaken in the Pacific Northwest. Assuming that sufficient funds are made available, a program of dam construction and generator installations has been drafted. Under this program, additional units would be added at Grand Coulee on a schedule that would bring installation of that plant up to its full 18 generators by 1952. It further assumed that the Anderson Ranch project would be in operation by 1949 and completed by 1953. In

1952 initial generation was assumed at Hungry Horse, Albeni Falls, Detroit, and lower Scriver Dams. By 1953 initial generation was contemplated at McNary, Ice Harbor, Big Cliff, Palisades, and Upper Scriver Dams, with additional generation at Hungry Horse and Detroit. Initial generation at Foster Creek, Meridian, Hills Creek, Dexter, and Garden Valley would be expected by 1954, with further service from McNary and Ice Harbor.

In addition to presently proposed Federal developments, the non-Federal utilities plan additions to existing plants which will be of importance to the regional power supply. The Montana Power Co. expects to have a second 56,000-kilowatt unit in operation at the Kerr plant by June 1949, and the Utah Power & Light Co. will have a 40,000-kilowatt steam-electric unit added to the Orem plant by July 1950. The Idaho Power Co. recently completed installation of 16,500 kilowatts of additional capacity at its upper Salmon plant and is now installing 7,500 kilowatts at upper Malad, 8,500 kilowatts at lower Malad, and 18,500 kilowatts at lower Salmon, all in 1948. The company also plans to add 34,500 kilowatts to the lower Salmon plant by May 1949.

Six units of 20,000 kilowatts each could be added at the Rock Island plant of the Puget Sound Power & Light Co. in 1950 and 1951, but this addition is not definitely planned by the company at this time. Also, another 45,000-kilowatt generator could be readily installed at the Ariel plant of the Pacific Power & Light Co. by September 1950. There is considerable doubt as to immediate plans for this improvement. The California Oregon Power Co. is now constructing the Toketee Falls project which will bring 25,000 kilowatts of new capacity into service by December 1949.

At the present time, the city of Seattle is increasing storage capacity by raising the Ross Dam. This will be a continuous operation, and a total increase of 1.4 million acre-feet of usable storage will be accomplished by the summer of 1951. The city plans to install one 60,000-kilowatt unit in the present Gorge plant, two 90,000-kilowatt units at Ross in 1952, and two like units in 1956.

The city of Eugene plans an addition to its Leaburg plant amounting to 7,500 kilowatts in 1949 and an addition to its Waterville plant amounting to 8,000 kilowatts in September 1950.

The total of the possible additions to regional power capacity amounts to 625,000 kilowatts, excluding the possible addition of 165,000 kilowatts at the Rock Island plant of the Puget Sound Power & Light Co. and the Ariel plant of the Pacific Power & Light Co. Table 8 shows the general specifications and location of authorized and unauthorized Federal projects which will be required if foreseeable deficits in the power supply are to be met by 1953–54.

TABLE 8.—*General specifications—authorized and unauthorized projects*

	Location	Proposed installations	Nominal prime power	Pool elevation	Usable storage	Average head	Purpose
AUTHORIZED PROJECTS		*Kilowatts* [1]	*Kilowatts* [2]	*Feet*	*Acre-feet*	*Feet*	
Hungry Horse	Montana	[3] 286,000	200,000	3,559.0	[3] 2,860,000	396	Storage and power.
Grand Coulee [4]	Washington	1,944,000	[5] 1,339,000	1,288.0	5,212,000	324	Irrigation, power, and navigation.
Foster Creek	do	1,024,000	[5] 683,000	937.5		171	Power and irrigation.
McNary	Oregon	966,000	[5,6] 562,000	340.0		87	Navigation and power.
Ice Harbor	Washington	300,000	[6] 185,000	440.0		93	Do.
Lower Monumental	do	290,000	[6] 177,000	533.0		89	Do.
Little Goose	do	290,000	[6] 190,000	633.0		96	Do.
Lower Granite	do	284,000	[6] 154,000	715.0		77	Do.
Anderson Ranch	Idaho	40,500	3,000	4,196.0	440,000	260	Irrigation and power.
Palisades	do	30,000	15,000		1,276,000	144	
Detroit [7]	Oregon	100,000	31,000	1,596.0	340,000	299	Flood control, navigation and power.
Meridian [7]	do	115,000	33,000	929.0	368,000	228	Do.
UNAUTHORIZED PROJECTS							
Hells Canyon	Idaho	1,235,000	744,000	2,075.0	3,500,000	512	Navigation and power.
Albeni Falls	do	42,000	32,000	2,062.5	1,140,000	24	Storage and power.
Hills Creek	Oregon	20,000	12,000	1,510.0	221,000	204	Flood control, navigation, and power.
Dexter	do	15,000	10,000	695.0		53	Do.
Big Cliff	Oregon	16,000	10,000	1,197.0		81	Do.
Lower Lemhi	Idaho	5,000	2,000				Irrigation and power.
Challis	do	5,000	2,000				Do.
Garden Valley	do	45,000	30,000	3,240.0	1,250,000	280	Do.
Upper Scriver	do	30,000	24,000	4,505.0		390	Do.
Lower Scriver	do	90,000	47,000	4,060.0		770	Do.

[1] Name-plate ratings.

[2] Average capability during the system storage control season.

[3] Final project designs are expected to provide for 3 million acre-feet of usable storage and a plant installation of 300,000 kilowatt.

[4] 6 of ultimate 18 units are now in operation and 6 units are being manufactured.

[5] Generation includes benefits from usable 2.86 million acre-feet of storage at Hungry Horse and 1.14 million acre-feet of storage at Albeni Falls.

[6] Generation includes benefits from usable 3.5 million acre-feet of storage at Hells Canyon.

[7] Power facilities are not authorized.

Even should this program proceed without delay, the prospects are that the power supply situation will continue to be critical until 1954, because the over-all power requirements of the Northwest may be expected to grow more rapidly than new generating equipment can be installed.

The only major source of increase Federal power supply during the period 1947–52 will be the installation of additional generating units at Grand Coulee Dam, since Bonneville Dam has been completed with its 10 generators being taxed to their limit. Beginning in November 1947, it is planned to install the seventh, eighth, and ninth generating units in the left powerhouse and to proceed with the installation of units 1 through 9 in the right powerhouse as rapidly as they can be manufactured and installed. By 1952 the 18 units at Grand Coulee Dam will have a combined peaking capability of 2,160,000 kilowatts. The firm energy capability of the 18 units, however, will be only 1,210,000 kilowatts.

The potential peak requirements on the Federal system are estimated to amount to 2,862,000 kilowatts and the potential firm energy requirements to 2,294,000 kilowatts by December 1952. In spite of the installation of the 12 additional units at Grand Coulee Dam, the potential peak load in the year 1952 will exceed by 230,000 kilowatts the combined peaking capabilities of all of the Federal plants on the Columbia and its tributaries and will be nearly 500,000 kilowatts in excess of their firm energy capabilities. In each year from 1947 to 1952 the region will face a shortage in peaking capability and in energy production.

EFFECT ON THE REGION

This continuing power deficit for the region is a cause of grave concern and poses corollary problems in power marketing for which solutions have not yet been found. One almost certain effect of the deficit will be a serious setback to the industrial growth of the region. Neither the Federal system nor the systems of the private and public power distributors in the region are able to offer any sizable blocks of firm power to industrial plants wishing to expand their operations or to new plants wishing to locate in the Pacific Northwest. Chemical and metallurgical plants of national significance will be unable to expand their domestic production by building additional plant units in the Northwest where adequate supplies of low-cost power should normally be available.

If adequate funds are appropriated by the Congress for the construction of additional authorized multipurpose hydroelectric projects on the Columbia River and its tributaries, additional generation from new dams can alleviate the power shortage by 1953 and bring power requirements and power supply into balance by 1954.

TRANSMISSION MUST ACCOMPANY GENERATION

The Bonneville Power Administration's transmission network must likewise be expanded very substantially during the next 6 years in order to deliver the output of Grand Coulee power plant to regional and local load centers. All main transmission lines and substations are now fully loaded. Accordingly it will be necessary to increase transmission network capacity in proportion to the generating capacity scheduled for installation at Grand Coulee Dam. It is also necessary to build transmission facilities to market the output of Hungry Horse, McNary, and several of the Lower Snake and Willamette Valley navigation and flood-control projects which will be brought into production commencing in 1952. Power must be moved in large blocks from the centers of generation in central and eastern Washington and Oregon and western Montana to the principal load centers in the Puget Sound, lower Columbia, southwestern Oregon, and Spokane areas. Intermediate transmission is also required to transmit the power in smaller quantities from these principal regional population centers to the local load areas now faced by acute power shortages. The magnitude of this transmission line construction program exceeds that yet experienced by the Administration.

In spite of the inability of the Federal system to meet the full potential requirements of the region during the period 1947–53, additions and improvements to the regional transmission grid system will be required throughout this period. These additions and improvements in transmission facilities are required not only to market the additional power that will become available through the installation of new generating units at Grand Coulee Dam but also to provide the maximum flexibility in available power supply during the shortage period. Without the new transmission facilities, the region would be in an even more desperate position with regard to power supply and the conditions of chronic power shortage in individual areas would continue unalleviated.

Southwestern Power Administration

DOUGLAS G. WRIGHT, ADMINISTRATOR

THE Southwestern Power Administration, under responsibility delegated by the Secretary of the Interior, and in accordance with section 5 of the Flood Control Act of 1944, is charged with the distribution and marketing of all surplus hydroelectric power and energy generated at multipile-purpose reservoir projects constructed, authorized for, or proposed for, constructed by the War Department in the Red, Ouchita, White, Arkansas, Brazos, Neches, Angelina, and Guadalupe River Basins in the States of Arkansas and Louisiana, that part of the States of Kansas and Missouri lying south of the Missouri River Basin and east of the ninety-eighth meridian and that part of the States of Texas and Oklahoma lying east of the ninety-ninth meridian and north of the San Antonio River Basin. This area contains approximately 350,000 square miles and has about 12,000,000 inhabitants.

During the fiscal year the Southwestern Power Administration, under section 5 of the Flood Control Act of 1944, marketed the surplus hydroelectric power and energy generated at the Norfolk Dam in Arkansas and the Denison Dam in Texas and Oklahoma. For a portion of the year it also operated the Grand River Dam project in Oklahoma and maintained for the Ark-La Electric Cooperative, Inc., their 154,000-volt transmission line in Oklahoma and Arkansas.

GRAND RIVER DAM PROJECT

The Grand River Dam project, located on the Grand (Neosho) River in the northeastern part of Oklahoma, constructed by the Grand River Dam Authority, an agency of the State of Oklahoma, under a Public Works Administration loan and grant agreement went into commercial operation May 1, 1941, with an installed capacity of 60,000 kilowatts. On November 21, 1941, under Executive Order 8944, its operation and management was taken over by the Federal Government for the war emergency and it continued to be operated and managed by the United States through August 31, 1946.

During the second session of the Seventy-ninth Congress, Public Law No. 573 (act of July 31, 1946) was enacted to return the Grand

River Dam project to its owner, the State of Oklahoma. This was accomplished on August 31, 1946, by a special settlement agreement between the Grand River Dam Authority and the Federal Government under the provisions of that law.

The Southwestern Power Administration made many improvements and additions to the Grand River Dam project while it was under Federal control. At the time of the turn-back the construction of transmission facilities and installation of the fifth generating unit were nearing completion.

For the portion of the fiscal year that the Grand River Dam project was managed and operated by Southwestern Power Administration the gross receipts from power sales amounted to $111,185.91 thus bringing the total power-sales revenue for the entire period the project was under Federal control to a grand total of $6,524,268.32. In addition to the above, there were other miscellaneous revenues for the entire period of Federal operation amounting to $183,750.81.

ARK-LA LINE

This 154,000-volt line, 200 miles in length, with terminal substations at Markham Ferry near Pryor, Okla., and Lake Catherine-Jones Mills near Hot Springs, Ark., was constructed by the Ark-La Electric Cooperative, Inc., to furnish power from the Grand River Dam project to the Jones Mills aluminum plant. The Oklahoma substation terminal of this line was adjacent to the Markham Ferry substation of the Grand River Dam project. Under agreement with the Ark-La Electric Cooperative, Inc., the Southwestern Power Administration operated and maintained this line during the war emergency. After cessation of hostilities, and the subsequent loss of load from the aluminum plant, the Southwestern Power Administration, under a supplemental agreement with the Ark-La Electric Cooperative, Inc., maintained this line for the cooperative.

On October 11, 1946, agreements were terminated and the line was returned to the Ark-La Electric Cooperative, Inc.

NORFORK DAM PROJECT

The Norfork Dam project, constructed and operated by the United States Corps of Engineers, is located on the north fork of the White River, in Arkansas. The project was designed for an ultimate installation of four 35,000-kilowatt generating units. Commercial operation with the first unit began on March 6, 1945, and the second unit is scheduled for installation in September 1948.

During the fiscal year, the Southwestern Power Administration, under section 5 of the 1944 Flood Control Act, continued to market the surplus power and energy generated at this project. In lieu of Government transmission facilities, the power was sold to the local private utility under temporary contracts. Revenue from this sale of energy during the fiscal year amounted to $656,035.12.

DENISON DAM PROJECT

This project located on the Red River and the Texas-Oklahoma border near Denison, Tex., also constructed and operated by the Corps of Engineers, commenced operation March 9, 1945, with one 35,000-kilowatt generating unit. The second of the five units proposed in the construction program is on order and will probably be available for service in September 1948. The third unit is urgently needed to alleviate the critical shortage of generating capacity in the area.

As in the case of the Norfork Dam project, lack of transmission facilities caused the Southwestern Power Administration to sell the surplus power from this project to two private utilities under temporary sales contracts. Revenues from these sales for the fiscal year amounted to $800,184.25.

ACCOMPLISHMENTS DURING FISCAL YEAR

The 1947 appropriation to the Southwestern Power Administration for the first time provided funds to construct transmission lines interconnecting the Norfork and Denison Dam projects and to initiate the power program authorized in the Flood Control Act of 1944. That act provides that surplus power and energy from these projects be made available in wholesale quantities to facilities owned by the Federal Government, public bodies, and rural electric cooperatives, as well as privately owned companies. Because there was no authority to employ engineering firms and consultants to assist in the preparation of technical plans, designs, and specifications it was necessary to organize a qualified staff in the headquarters office at Tulsa, Okla., and at small field offices in order to work out the most economical and effective system to accomplish the purposes set forth in the appropriation law and Flood Control Act. In spite of this handicap, the first year's program consisting of about 400 miles of 154,000–132,000-volt transmission line connecting the Norfork and Denison Dam projects, and about 130 miles of 66,000-volt feeder lines were contracted for during the fiscal year.

In the last few months of the fiscal year, a unique type of contract was executed between Southwestern Power Administration and the Texas Power & Light Co., for the sale and disposition of a part of the surplus power and energy generated at the Denison Dam. This contract shares the benefits derived by coordinating the facilities of the private utility and the Government and provides a vehicle for delivering Government power to Federal loads, rural electric cooperatives, public bodies, and others at the lowest possible cost commensurate with sound business principles as prescribed in the Flood Control Act of 1944. It may well serve as a guide for the consummation of contracts to be worked out with other private utilities in the Southwestern Power Administration's area for the marketing of surplus power and energy from multiple-purpose hydroelectric projects now under construction and those planned by the Corps of Engineers.

Studies of available and potential markets for disposition of power to public bodies, cooperatives, and private companies were continued during the year and special effort was made to arrange for service to cooperatives in their rural electrification programs.

Detailed studies were made of cost allocation problems and after considerable correspondence and various conferences with other Government agencies having similar problems, the Corps of Engineers, the Federal Power Commission, and the Tennessee Valley Authority, it is believed a satisfactory basis has been worked out for the allocation of costs on the Norfork and Denison projects. The method to be used on these projects, however, will not necessarily be a criterion for other projects now being constructed or to be constructed in the area served by Southwestern Power Administration.

Acquisition of lands, easements and rights of flowage to create an additional 5-foot of storage area in the Pensacola Reservoir of the Grand River Dam project as required under license issued by the Federal Power Commission to the Grand River Dam Authority, were completed during the fiscal year. This work was authorized by letter of December 10, 1942, from the President to General Fleming, Administrator of the Federal Works Agency.

LOOKING FORWARD

One of the main activities of the coming fiscal year will center around the $7,500,000 construction program consisting of approximately 400 miles of 154,000–132,000-volt tie line and substation to connect the Norfork and Denison projects and approximately 130 miles of 66,000-volt transmission lines in Arkansas, Missouri, and Oklahoma. With the exception of the 154,000–132,000-volt substation contracts for this work were executed during the latter part of the fiscal year 1947 and construction was initiated in that year.

The contract between Southwestern Power Administration and the

Texas Power & Light Co. executed the latter part of the fiscal year 1947 has already shown noticeable evidence of its potential influence on the power situation in the Southwest indicating to some degree at least the possibilities of this contract. In the short period of time this contract has been in existence numerous inquiries have been received from public bodies and cooperatives and several negotiations are in progress for service of power under the provision of this contract.

As a further indication of the trend of public and private power in the Southwest, influenced to some extent by the consummation of the contract with the Texas Power & Light Co., proposals have been received from other private utilities in the area relative to working out an agreement for the surplus hydroelectric power and energy generated at the Norfork and Denison Dams which will be available for general distribution when the connecting tie line between these dams now under construction is completed. Negotiations to consummate a mutually satisfactory contract with these companies will continue into the 1948 fiscal year.

Other multiple-purpose dams under construction or to be constructed in the area, have a decided bearing on the programs of Southwestern Power Administration. The United States Corps of Engineers have started construction work on six new river development projects in the power marketing area of Southwestern Power Administration. The power capacity at these projects, together with the additional generating units at the two projects now operating in this area, will add 316,400 kilowatts to the power available for disposition by this agency. Of this amount, 70,000 kilowatts is scheduled to be available late in 1948 or early in 1949. The greater part of this capacity is expected to become available for sale and disposition during the period 1952 to 1956. Four additional river development projects which have been authorized by Congress and on which the United States Corps of Engineers is preparing plans will add another 146,000 kilowatts to the power available in this area within a decade.

Bureau of Mines

R. R. SAYERS, DIRECTOR

STRIVING to maintain a mineral position strong enough to support the stature of the United States in international affairs, the Bureau of Mines last year centered primary attention on a quest for new ore and coking-coal reserves, research to develop economical methods for using low-grade resources, conservation of petroleum, perfection of synthetic liquid-fuel processes, safety in mines, and a mineral fact-finding program.

High-grade ore deposits have been greatly depleted. The Nation's self-sufficiency in certain essential minerals continues to be threatened. In an effort to help meet this threat to our industrial supremacy, the Bureau examined 275 deposits of strategic and critical minerals. It conducted development work on 62. It also investigated intensively more than 100 metallurgical problems retarding the use of domestic raw materials vital to continued full employment and prosperity.

The Army-Navy Munitions Board strategic list now contains 50 minerals compared to 7 in 1940. Emphasis again has been placed on lead and zinc, because of the persistently acute shortage of these metals. Some success has been achieved in marking out added reserves of lead and zinc ores and in delineating deposits of copper, iron, titanium, mica, and barite.

After a wartime lull, studies were resumed on new mining methods and labor-saving equipment developed by industry, including innovations in stoping, shaft sinking, and the use of diamond drills for sinking blast holes. In addition, original research was conducted on core-drill abrasives and the application of shaped explosives charges to mining. An improved portable microseismic recorder was developed for determining when and where rock falls may be expected in mines.

In the metallurgical field, the Bureau's accomplishments were impressive. Some can be measured in terms of immediate returns, while others offer industrial promise of such magnitude that it is difficult to visualize their full import.

Ferrous metallurgical studies were intensified in response to a demand for special steels. Stronger and more durable alloys were produced, meeting rigid specifications. High-grade sponge iron, an excellent substitute for scrap, was manufactured. New structural metals were developed to supplement those now in dwindling supply after long use.

Electrolytic manganese, chromium, and cobalt were made from domestic materials. Titanium and zirconium, metals with unique and valuable properties, were produced by Bureau processes. Large samples of these metals were distributed to industry to establish the uses for which they are best adapted, and the demand remains far greater than the supply.

Extraction of pure alumina from low-grade bauxite and clay was proved technically feasible, and progress was made toward utilizing domestic magnesite, dolomite, and olivine for the manufacture of metallic magnesium. Aluminum and magnesium were separated successfully from light-metal scrap, and a survey disclosed promising byproduct sources of thallium and gallium, both now of military importance.

In the field of nonmetallics, the Bureau produced lightweight products for concrete aggregate and insulation purposes from perlite, a volcanic rock available in enormous quantities. It also demonstrated how a strong, light building material can be obtained from many clays, high-grade refractory products from sillimanite minerals, excellent insulators from domestic talcs, and ceramic bodies from domestic kaolin.

Concerned by the increasingly acute shortage of good-quality coking coal, the Bureau charted usable reserves of more than 500,000,000 tons in Maryland and Alabama, undertook several new projects, and studied preparation methods to up-grade lower-quality coals. Numerous research studies were carried forward promoting more efficient mining, preparation, and utilization of coal. As in former years, the Bureau's technical guidance was widely sought on fuels and fuel-burning equipment, boiler corrosion, smoke abatement, coal shortage, and kindred problems. More than 18,000 samples of carbonaceous materials were analyzed, and many explosives and types of mining equipment were tested.

With petroleum consumption at a new all-time high and oil imports exceeding exports for the first time, the Bureau placed in operation its first synthetic liquid-fuels demonstration plant—an oil-shale processing installation at Rifle, Colo. Conversion of a wartime ammonia plant at Louisiana, Mo., to the production of oil from coal entered the construction stage, and synthetic fuels laboratories at Bruceton, Pa., and Laramie, Wyo., were virtually completed. Meanwhile, engineering studies were made in a dozen oil fields; and numerous research problems were solved, all promoting more thorough extraction and better utilization of natural petroleum. Helium shipments from the Bureau's plants to commercial consumers surpassed prewar years by ninefold, and still were rising.

Under the Krug-Lewis agreement and the subsequent Federal Mine Safety Code, health and safety activities of the Bureau reached new heights last year and accomplished more than in any similar period in history. Thousands of safety improvements made during the mandatory compliance period of the code were deemed to have left the bituminous-coal mines in safer condition than they had ever been before.

During the year in which the Federal Government operated most of the Nation's larger coal mines, Bureau inspectors made more than 4,600 regular and special inspections. Compliance with their recommendations increased from 28 percent before the Centralia, Ill., explosion to 48 percent after that disaster.

Bureau instructors trained nearly 30,000 persons in first-aid and mine rescue procedures, and more than 2,000 others took mine-safety and accident-prevention courses. Bureau men also investigated 47 explosions and mine fires, tested and approved electrical equipment for use in mines, analyzed thousands of gas and dust samples to detect hazards, and conducted studies on mine ventilation, control of anthracite mine floods, and safe operation of Diesel locomotives underground.

Maintenance of high levels of industrial activity in the face of shortages in mineral supply and an increasing dependence on foreign sources for minerals required up-to-date information on mineral developments throughout the world. Fulfilling hundreds of requests, the Bureau compiled and issued economic and statistical facts on domestic and foreign production, stocks, distribution, and consumption.

SUMMARY OF ACTIVITIES

Mineral Development

As a contribution to national security in terms of strategic and critical minerals, the Bureau carried on a vigorous peacetime program in the investigation and development of domestic mineral deposits and in the extraction and purification of metals and nonmetallics.

Examining 275 deposits and doing development work on 62 containing strategic and critical ores, the Mining Branch also resumed studies on new mining methods and labor-saving equipment developed by industry, experimented with military explosives in metal-mine blasting, developed a method for predicting rock falls in mines, and studied the possibilities of Missouri River Basin mineral industries.

In laboratory and pilot plant, the scientists of the Metallurgical Branch demonstrated that Bureau-developed pure metals, such as electrolytic manganese and chromium, could be used effectively in steel production and that sponge iron is a worthy substitute for scrap in steel making. They also treated lead-zinc ores with an electrometallurgical process; produced the new, light metal, titanium, in modest quantities for the first time; studied a German method for metal recovery; experimented with thallium, gallium, and other rare metals; and carried on extensive research in ceramics, refractories, abrasives, and other industrial minerals.

Mining Branch

Strategic minerals program.—With about 50 metals and minerals on the strategic and critical list of the Army-Navy Munitions Board, the Bureau proceeded carefully in examining mineral deposits essential to the common defense and industrial needs of the Nation. Although emphasis again was placed on lead-zinc deposits because of their continued shortage, 14 commodities were investigated. These included 36 lead-zinc, 8 copper, 4 iron, 2 fluorspar, 2 asbestos, 1 barite, 1 corundum, 1 mercury, 1 mica, 1 molybdenum, 1 rutile, 1 tungsten, 1 zircon, and 2 nickel projects. Preliminary examinations were conducted upon 275 deposits, and actual development work was performed on 62 distributed throughout 26 States and Alaska.

Successful Bureau investigations were completed on two copper deposits of 1,200,000 tons containing 2.3 percent copper; two eastern magnetic iron-ore deposits of 19,000,000 tons, containing 26 percent iron; six lead-zinc deposits of 363,000 tons, consisting of 2.5 percent lead and 4.7 percent zinc; black-sand deposits of 21,000,000 tons, composed of 54 percent titanium, 15 percent zircon, 14 percent staurolite, 6 percent sillimanite, 5 percent tourmaline, and 3 percent kyanite; a mica deposit of 100,000 tons, containing 5 percent sheet mica; and a barite deposit of 220,000 tons, containing 68 percent barium sulfate.

The Bureau concentrated on investigating deposits containing enough metal to meet a sizable part of the Nation's needs in any emergency, but unfortunately too low in grade to be profitable in ordinary times. The Bureau generally did not conduct investigations on deposits that could be developed by private enterprise and become commercial in the immediate future. Completing 66 project reports, the Bureau published and made available to the mining industries 128 reports, including wartime strategic mineral investigations.

The Bureau's long-range program of establishing mineral resources for future use gave way in 1939 to a national defense program of finding minerals needed urgently and immediately. Seven metals usually imported were on the original Army-Navy Munitions Board list when World War II started, but the list was rapidly expanded to include almost all critical metals and minerals. Although in many instances the location of low-grade deposits was known, production could not get under way promptly because methods of mining and treating ores had not been worked out well in advance. Profiting from wartime experience, the Mining and Metallurgical Branches worked closely together last year in a long-range program designed to prevent similar dangerous delays in any crisis.

Mining-method studies.—The Bureau resumed studies on new mining methods and labor-saving equipment developed by industry, including many wartime innovations introduced into the Nation's mines. By the end of the fiscal year, 10 papers on the use of diamond drills for blast-hole drilling in stopes (mining excavations) had been prepared, with 4 published. Four additional reports on shaft sinking and stoping or excavating operations also had been completed. Each publication presented information on mining costs in terms of labor, power, and supplies, permitting operators to compare various mining methods and make improvements.

Experimental studies.—In addition to studying industrially developed mining methods, the Mining Branch conducted its own research to improve mining equipment and techniques, including studies on core-drill abrasives and the use of shaped charges in mining at its experimental hard-rock mine, Mount Weather, Va.

Experimenting with the use of shaped charges for shattering oversize boulders and for making holes in solid rock during blasting, the Bureau found that smaller charges were unsatisfactory and that larger charges were effective but uneconomical. Shaped charges were used during the war for penetrating armor and demolishing fortifications. In search of a substitute for high-priced imported industrial diamonds, used in diamond-bit core drilling for preliminary sampling of ore deposits, the Bureau tested approximately 10 different abrasives. One was used successfully in drilling 25 feet in the moderately tough greenstone at the experimental mine. Although drilling speed was somewhat slower than when using diamonds, the bit cost per foot drilled was comparable.

Important both as a safety and conservation measure, the Bureau further developed a standardized procedure for testing physical properties of mine rocks. Through a "microseismic" technique, scientists can determine pressure on parts of a mine structure and predict when and where rock failure might occur. With this knowledge, men can be removed from a dangerous place in a mine before a roof-fall. Pillars of ore formerly considered necessary for roof support also could be safely mined. During the war, this technique was used to aid in removing approximately 1,000,000 tons of ore from iron and zinc mines. In this connection, the Bureau also developed an improved portable microseismic recorder, prepared an instruction book on how to use the equipment for inexperienced operators, made microseismic field investigations at Jefferson City, Tenn., and Ishpeming, Mich., and conducted a field study of peculiar mine-roof failures in the Scott's Run coal district of Monongalia County, W. Va.

At the experimental mine, Mount Weather, Va., the Mining Branch also studied new mining tools, ways to control dust from blasting hard rock, and numerous alloy steels for rock-drilling purposes in metal mines and maintained an extensive underground storage room containing core samples from many eastern metal mines.

Missouri River Basin studies.—In cooperation with the Bureau of Reclamation, the Mining Branch investigated the potentialities of the mineral industries in selected areas of the Missouri River Basin. These studies were related to individual reclamation projects and to the future development of the whole basin. Studies of single deposits were compiled and correlated into district investigations considering the development of various complementary mineral products. Complete comprehensive district reports will be issued to determine the mineral resources available for electric power and the general development of the basin. Eight studies were in progress during the year, and four preliminary reports were published.

Metallurgical Branch

Iron, steel, and ferro-alloys.—The Bureau's metallurgical iron and steel research program is built around the use of pure metals—never before obtained in quantity—from low-grade domestic ores. Electrolytic manganese, developed by Bureau scientists a few years ago, was used again in last year's research, as were electrolytic chromium and cobalt.

Electrolytic manganese and chromium were alloyed with sponge iron to produce steels at the Bureau ferro-alloy plant at Redding, Calif. Over 1,000,000 pounds of electrolytic manganese were produced at Boulder City, Nev., and tested at commercial steel plants. In industrial tests, Bureau-developed pure manganese proved equal or superior to ordinary grades of ferromanganese in steel production and opened the possibility of using large reserves of low-grade ore. New ferrous and nonferrous alloys with unusual properties also were produced in Bureau plants, and further tests on pure chromium—the basic alloying element of stainless and heat-resisting steels—were planned.

At Boulder City, Nev., another pure metal, cobalt, was produced by the Bureau through a new electrolytic method. Of increasing importance to industry, cobalt has been successfully used in steels and other ferrous alloys, in magnetic alloys, as a binding material in carbide tools, and in the production of gas turbines and rocket engines. Smelting campaigns on raw materials found in the Pacific Northwest also were carried out at Albany, Oreg., a study was made of slag-metal reactions in steel making, and a valuable theory in accordance with accepted principles of physical chemistry was advanced.

Sponge iron.—In industrial tests at steel plants, Bureau-produced sponge iron was used successfully as a scrap substitute in the production of high-quality steel suitable for the manufacture of tools and cutlery. In addition to these tests, three different types of research in sponge iron were conducted during the year. Following the production of nearly 500 tons of sponge iron in periodic kilns at Canton, Ohio, the Bureau built a sponge-iron pilot plant at Salisbury, N. C., and successfully adapted a ceramic tunnel kiln to a Swedish process for manufacturing sponge iron. This project was completed during the year. At Minneapolis, Minn., a pilot-plant-scale vertical-shaft furnace for the gaseous reduction of iron-ore glomerules was constructed, and sponge iron was produced at the rate of about 500 pounds per day. This process proved effective in the manufacture of iron powder. At the Bureau sponge-iron plant, Laramie, Wyo., the Bureau investigated the use of low-grade iron ores in sponge-iron production by a modified Krupp-Renn process and proved that their use was economically practical.

Nonferrous metals.—Although a shortage of high-grade sulfide lead-zinc ores existed in the United States, the Bureau made much progress in treating oxidized lead-zinc ores—low-grade ores that cannot be treated successfully under present commercial metallurgical methods. Containing many undesirable constituents, large deposits of these complex submarginal ores are located in the West. Ores from southern Nevada, composed of lead, zinc, copper, and precious metals, were tested by an electrometallurgical process, which separates the lead-smelter constituents from the zinc and gives promise of making economically possible the use of previously unsalable oxidized lead-zinc ores. Other tests on Pacific Northwest ores were conducted at Albany, Oreg. In past years, smelters have refused to take oxidized lead-zinc ores because of the great difficulties in separating the undesirable constituents. High transportation costs for shipping the ores to smelters also made their use economically impractical. Last year, Bureau metallurgists also offered valuable advice to the lead-smelter industry in the Tri-State district of Oklahoma, Missouri, and Kansas, resulting in a saving of many tons of lead and zinc. Modification of existing practices increased output and decreased costs.

Light metals.—Titanium, a metal twice as strong as common steel and half as heavy, with a corrosion resistance equal to many of the finest alloys, was produced in quantity by the Bureau for the first time last year. Hundreds of pounds of this new metal were processed at a Bureau-operated pilot plant at Boulder City, Nev., and made available for research. In cooperation with the War and Navy Departments, the Bureau began studies on high-temperature-resistant materials to develop new alloys for jet planes, rockets, and guided missiles. Ranking fourth in abundance among engineering materials, titanium could replace aluminum, magnesium, and ferrous products in a variety of uses.

Most small-scale alumina projects were completed by the Bureau during the year, and research was directed toward the development of new raw materials, excluding bauxite, and the up-grading of marginal and submarginal bauxites. Several stand-by processes employing domestic raw materials other than bauxite proved practical, indicating that the Nation could depend in emergencies upon domestic sources if adequate production facilities were available. At Bauxite, Ark., the Bureau also demonstrated that marginal bauxite could be up-graded, using heretofore worthless material in time of emergency.

To insure enough secondary metal scrap in a crisis, the Bureau installed a unit for metal-recovery studies at College Park, Md. Based in part on German wartime research, a process was developed for removing impurities from liquid metal by filtration similar to the removal of coffee grounds by a strainer. Processing aluminum airplane scrap, a ton-a-day pilot plant was operated continuously for over 150 hours and produced relatively pure zinc-aluminum alloy from which high-purity aluminum could be separated. Carbothermic magnesium production also was successfully completed by the Bureau at Pullman, Wash., and the results served as a basis for a large pilot plant at Albany, Oreg.

Rare metals.—Considerable metallurgical research was conducted by the Bureau on so-called "rare metals"—those seldom extracted because of hitherto limited or no industrial use. During the year, two new metals in this group achieved strategic importance—thallium and gallium. Previously used only for rodent poisoning, thallium proved its military significance during the closing days of World War II when German infrared equipment was found with lenses and prisms containing this element. Possessing higher transmission characteristics in the infrared range than any known practical material, thallium compounds came into immediate demand. A Bureau survey made at the request of the Army Engineer Corps demonstrated the existence of relatively large quantities of thallium in ores, processing streams, and finished products of the Salt Lake Valley, and methods for its detection and determination were soon developed. An even rarer metal, gallium, long known to possess the highest liquid range of any known element, also became of military importance. Bureau surveys got under way during the year, indicating great waste of the metal in some nonferrous metal industries. Further progress also was made on the isolation of zirconium metal. After completing small-scale laboratory studies, the Bureau constructed a pilot plant at Albany, Oreg., where batches as large as 60 pounds were processed. Zirconium is one of two structural metals inert to hydrochloric acid. The other metal, tantalum, is in limited domestic supply, and is expected to be replaced by zirconium for numerous purposes.

Nonmetallic minerals.—In the field of nonmetallic or industrial minerals, the Bureau conducted extensive tests on structural materials, ceramic and refractory bodies, electric insulators, abrasives, pigments, and metallurgical fluxes and heavy chemicals.

To help meet the great postwar demand for housing materials, the Bureau made intensive studies on raw materials suitable for concrete aggregate and home insulation. By heating (under controlled conditions) perlite, a volcanic rock occurring in huge quantities in certain Western States, the Bureau attained highly expanded products acceptable for lightweight aggregate and heat insulation. Of even potential wider application, the Bureau mixed clay with about 2 percent sulfur and expanded the mixture through heating into a strong, light, waterproof product excellent for building purposes.

Studying ceramic and refractory bodies, the Bureau developed refractory brick from domestic sillimanite minerals, which met rigid Navy specifications. Adding other materials, including Bayer alumina, bauxite, kaolin, zircon, and topaz, the Bureau began tests on over 60 different combinations. Various types of porcelain and china, equal or superior to imported products, also were produced from domestic kaolin fired in an electric kiln—advantageous for use in cheaply powered areas.

To supply the growing need for electric insulators, the Bureau prepared synthetic steatitic bodies having properties as good or better than insulators produced from higher-grade natural block talc. With domestic sources of sheet mica inadequate, experiments also were begun to produce synthetic mica suitable for use in any future crisis.

In search of a substitute for expensive imported industrial diamonds, used in mining operations, the Bureau studied the production of abrasives and cutting tools of exceptional hardness and durability. Although boron carbide proved the hardest man-made product, it lacked the toughness necessary for cutting tools and drilling equipment, and additional Bureau tests were begun to strengthen boron carbide with allied products.

Of importance to the paint industry, the Bureau devoted much time during the year to the recovery of titanium dioxide as a main product from ilmenite and as a byproduct in treating titaniferous iron ores from New York and Wyoming. A marketable-grade titanium, one of the most valuable and widely used white pigments, was obtained through a metallurgical process now being modified to recover vanadium as an additional byproduct.

In research in fluxing materials and heavy chemicals, the Bureau developed methods for concentrating low-grade fluorspar, investigated vast deposits of low-grade phosphates of interest to the fertilizer industry, and studied methods of recovering vanadium in these phosphates as a valuable byproduct.

Coal and Coal Products

A growing shortage of high-grade coking coals in the United States and the failure of petroleum production to pace all-time high consumption last year placed added importance upon Bureau of Mines technologic research on coal and coal products.

In Maryland and Alabama, over 500,000,000 tons of coal that could be used for metallurgical coke were marked out. Investigation of a western Colorado coking-coal deposit was continued, and in Alaska examination of a bed of high-grade bituminous coal was started. Exhaustive laboratory tests of coking and other properties of the coals were made during the year. Research in subbituminous coal and lignite on a pilot-plant scale was carried on.

Accelerating the long-range synthetic liquid-fuels program, the Bureau began operating an oil-shale demonstration plant at Rifle, Colo., producing about 100 barrels of oil a day. Conversion of the Missouri Ordnance Works plant at Louisiana, Mo., into a coal-demonstration plant was speeded, and a coal research and development laboratory at Bruceton, Pa., was nearing completion.

Conservation and safety were the keynotes in other extensive research in the mining, preparation, and utilization of coal. Fuel-burning equipment for 38 new veterans' hospitals was recommended, and fuel-utilization service for Federal agencies resulted in saving thousands of dollars. Over 18,000 samples of coal, coke, char, tar, pitch hydrogenated residues, heavy oils, pasting oils, organic compounds distillation fractions, and coal-mine dusts were analyzed during the year. This included nearly 7,000 samples of mine dust from the Nation's largest producing coal mines—a part of the program to control underground mine explosions. Smoke-abatement advisory service was given to cities in 14 States. New mining equipment was tested, and many special research problems were completed.

Coal mining and investigations.—The increasing concern over depletion of high-grade coking-coal reserves brought requests from industry for possible alternative coal supplies for making metallurgical coke. Two investigations were completed, indicating 500,000,000 tons of coal in Maryland and 14,000,000 tons in Alabama. By using suitable preparation methods, this coal could be used for making metallurgical coke. Other projects got under way in Maryland and North Carolina. An investigation of a promising coal reserve in western Colorado—a potential source of supply for the West's steel industry—was continued. In Alaska, an examination of an easily accessible source of high-grade bituminous coal was begun to determine minable reserves of coal for supplying the Alaska Railroad area. The Bureau tested and found scrapers and other light earth-moving equipment practical for certain strip-mining areas, studied pillar extraction with mechanized equipment, tested successfully a shearing machine suitable for cutting steeply pitching anthracite beds, and began construction of a new-type coal planer with vibrating blades designed to shear off and load coal simultaneously in longwall mining.

Coal preparation.—As another phase of the program to provide more coking coals, the Bureau studied ways to up-grade high-sulfur or high-ash coals to make them suitable for metallurgical use. Preparation studies were made on newly discovered Maryland coal reserves and on coal from western Pennsylvania, and a method for recovering previously wasted fine-size coking coal was developed and put on the commercial market. To improve the beneficiation of lower-grade coals, a Bureau survey of typical industrial preparation plants was begun. Research in coal-preparation practices in western Europe also disclosed new ash-removal methods and technologic developments, including ways to prepare very low ash coals for the synthetic liquid-fuel industry. A building to house the Bureau's coal-preparation pilot plant was completed at Bruceton, Pa.

Synthetic liquid fuels.—The Bureau's research and demonstration program for producing synthetic liquid fuels from coal, lignite, and oil shale grew in importance during the year. American petroleum production did not pace consumption, and the Nation became a net importer of oil. Increased drilling failed to uncover large new oil deposits. Therefore, results of the Bureau's research will be needed for large-scale application sooner than expected.

Of the four major installations under construction, the oil-shale demonstration plant on the Naval Oil Shale Reserves near Rifle, Colo., began producing 100 barrels of oil per day, and new laboratory facilities were completed at Laramie, Wyo., for further research on the Nation's oil-shale reserves—estimated at 92 billion barrels. New pilot plants and laboratories were nearing completion at Pittsburgh, Pa., and at Bruceton, Pa., where several improved methods that promise lower costs for gasoline and oil from coal were under development. A wartime ammonia plant at Louisiana, Mo., was being converted into a coal-hydrogenation demonstration plant capable of producing 200 barrels of gasoline from coal each day. A pilot plant for gasifying powdered coal in the production of oil was operating and another being built in Morgantown, W. Va. In cooperation with the Alabama Power Co., a revolutionary experiment in underground gasification was conducted at Gorgas, Ala., where an isolated block of coal was ignited and successfully gasified. Gasification is required in both processes under investigation for making oil from coal.

Coking and gasification studies.—As another aid in the search for new coking coals, the Bureau investigated the carbonizing properties of coals in Kentucky, Virginia, Pennsylvania, and Alabama. Similar tests were made on Venezuelan coal and Argentine asphaltic material. Completing a study on the storage of coking coals for periods up to 3½ years, the Bureau found that the stored coal lost coking power and heating value, with variable effects on byproduct yields. The Bureau also studied the effect of coal size upon carbonizing properties and achieved complete gasification of lignite in a series of tests.

Coal combustion.—The Bureau continued its research in the use of protective coatings to minimize corrosion of boiler tubes and investigated heat absorption and the effect of coal-ash slag in operating large central-station boiler furnaces. Simulating domestic furnace conditions, the Bureau studied the volume of smoke produced by various types of packaged fuels. Eight tests also were conducted on a gas producer designed to make rock wool and gas from Rhode Island anthracite.

Gas- and dust-explosion research.—As preventive measures against coal-mine explosions, the Bureau continued research in rock dusting at the Experimental mine, Bruceton, Pa., developed a new revolutionary theory of ignition in studying ignition hazards of explosive gases by electric sparks, demonstrated the effectiveness of pressure-relief vents suitable for use in industrial plants, and studied ways to eliminate dangerous conditions when operating gas-turbine railway locomotives with pulverized coal. In addition, the Bureau successfully solved problems involving ignition temperatures, inflammability limits, and flame extinction and tested over 90 samples of various dusts and powders, bringing the total number examined to 1,200. This information was used in the preparation of State and national safety codes.

Petroleum and Natural Gas

With peacetime demands for more than 5 million barrels of oil per day exceeding the wartime peak, petroleum and natural-gas fields produced at or near their maximum rates last year and supplied nearly one-half of the Nation's total energy requirements. This heavy drain on petroleum resources brought sharply into focus the Bureau's vital research designed to develop better methods of extracting the most oil from underground reservoirs and to increase the benefits from oil already produced.

Engineering studies were conducted at the Carthage, New Hope, Chapel Hill, and Red River fields in Texas; at the North Lindsay, Delaware-Childers, and Weber fields in Oklahoma; at the Brennamen and Boggs fields in West Virginia; and at the Rangeley field in Colorado, Lance Creek field in Wyoming, and the Atlanta field in Arkansas. Assisting oil operators of the Wichita Falls area, the Bureau applied stimulative oil-production methods to many wells in the north Texas field.

Research problems started or finished included the siphon flowing of oil wells as a means of reducing operating costs, recovery of oil from large surface or near-surface oil-impregnated deposits, more efficient secondary recovery methods, better use of crude oils, effect of sulfur in petroleum, and the thermodynamics of hydrocarbons. In addition, the Bureau determined 70 alloys and alloyed steels which proved resistant to corrosion and suitable for production equipment in gas condensate fields, began a semiannual aviation-gasoline survey, and continued a semiannual motor-gasoline survey.

In further cooperation with the American Gas Association, the Bureau initiated studies of the flow of gas through high-pressure pipe lines and the removal of nitrogen from natural gas, which will improve service to gas consumers. A report on the formation of gas hydrates in pipe lines was in the final stages of preparation at the end of the year and is expected to contribute substantially in maintaining high operating efficiency of pipe lines—important during the current record-breaking demand for natural-gas fuel.

Helium

Helium, the lightweight and nonburning "miracle gas" produced exclusively by the Bureau of Mines, was used increasingly in industrial, commercial, and medical enterprises last year. More than 13,000,000 cubic feet, or 21 percent of the total production of over 63,000,000 feet, was shipped to commercial consumers from the Bureau's Amarillo and Exell, Tex., plants. This is a ninefold increase over prewar years.

At the end of the year, indications were that the fiscal year 1948 would see the greatest volume in history used by commercial consumers. The peacetime uses for helium include the welding of certain metals by helium-shielded arc-welding processes; inflation of airships now in private use; as a tracer gas in mapping underground petroleum reservoirs; in operating rooms to eliminate explosion hazards; and a variety of medical uses, including the treatment and prevention of caisson disease and treatment of some respiratory diseases.

Continuing helium research, the Bureau studied better techniques for using helium in welding and metallurgy, more efficient helium extraction, cheaper means of transportation, and new uses for helium in tracing the flow of oil and gas in underground reservoirs and developed new equipment for producing, on a large scale, helium of 99.7 percent purity. Through an act of Congress, the Bureau also acquired for Federal use the Rattlesnake helium-bearing gas field in New Mexico in an agreement with the Navajo Indian Tribe and two private oil companies.

Explosives Testing and Research

To help industry minimize hazards in the manufacture, storage, and use of explosives, the Bureau tested over 2,300 permissible explosives and blasting devices, new types of industrial explosives, and dangerous chemical materials. Six new explosives were added to the permissible list, raising the approved number to 186. Following 650 large-scale tests, the Bureau approved an increase in the maximum charge weight of permissible explosives from 1.5 to 3 pounds per shot. The Bureau also conducted important research in explosives and propellants, including the ignition of firedamp by explosives, and investigated the explosions of two shiploads of ammonium nitrate fertilizer at Texas City, Tex., and of perchloric acid at an electroplating plant in Los Angeles, Calif.

Safety and Health Activities

With the Federal Government in custody of most of the large coal mines of the Nation last year under the terms of the Krug-Lewis agreement, the mine-safety work of the Bureau of Mines reached an all-time peak and contributed materially to improved conditions in the industry. Underground safety and the prevention of explosions keynoted the year for industry, workers, and Government.

Both in formulating the Federal Mine Safety Code and assisting the Coal Mines Administration in enforcing the standards, the Bureau of Mines performed essential services.

The code, placed in effect July 29, 1946, in all Government-operated mines, was written by the Bureau's Director and associates, with advice of an industry-union-Government committee. Regarded as a significant advance in American mine safety, the code is the most complete and practical set of standards ever assembled.

The Bureau's staff of less than 200 inspectors, experienced and capable through years of examining mines under the Federal Coal Mine Inspection Act of 1941, carried an extra-heavy load of work during the code period of operation. Their job, under the Krug-Lewis agreement and the code, was to inspect and reinspect mines and to report conditions to the Coal Mines Administration for action. During the year ended June 30, 1947, they made over 4,600 regular and special inspections. When the Coal Mines Administrator closed 627 mines following an explosion in Illinois in March 1947, most of these mines were federally inspected before being declared safe for reopening.

Findings on all of the mines inspected during the year, including code and noncode pits, were made public in accordance with the 1941 Coal Mine Inspection Act. Copies of preliminary and final reports were sent to operators, unions, and State mining authorities. Summaries of the reports were furnished to newspapers and others in the areas where the inspections were made.

Continuing the downward trend of the last 5 years, the fatality rate in bituminous-coal mining was 1.50 deaths per million tons in the calendar year 1946—the lowest in history. Monthly fatality rates for the first 6 months of 1947 ranged from 1.20 to 1.38, with the exception of March, when the rate was 3.45 because of the heavy death toll in the Centralia, Ill., explosion. However, competent authorities consider the bituminous-coal mines now in the safest condition in history as a result of the thousands of improvements made during the mandatory compliance period of the code.

Other functions and services of the Bureau also combined to produce an encouraging safety outlook in the mining industry last year. Nearly 30,000 persons were trained in first-aid and mine rescue, and over 2,000 miners were given mine-safety and accident-prevention courses. At 45 mines, 100 percent of the workers took first aid. Bureau men investigated 47 explosions and mine fires, tested and approved new electrical equipment, and studied ways to control anthracite mine floods.

To improve health conditions in mines and plants, the Bureau analyzed 16,000 gas and dust samples, informed operators how to control dust hazards, approved respiratory devices for protection against gases and dusts, continued research in mine and tunnel ventilation, and studied the operation of Diesel locomotives underground.

Coal-mine inspection.—While the Government-operated bituminous mines were complying with provisions of the Federal Mine Safety Code last year, the anthracite (hard-coal) mines were working under a separate set of safety standards adopted in the anthracite wage agreement of June 7, 1946, between the mine workers and the operators. For bituminous mines not under Government operation, the Bureau of Mines inspectors used the Federal Mine Safety Code as a guide in making recommendations.

In the inspections of the code mines, the Bureau had no enforcement powers, except that an inspector could withdraw men from a mine if he found conditions of "imminent danger." Otherwise, his report and recommendations were transmitted to the Coal Mines Administrator, whose duty it was to obtain compliance with provisions of the code. In anthracite and noncode mines, the Bureau of Mines disseminated the reports and summaries of the reports, in accordance with the 1941 inspection act.

The Bureau's field force for coal-mine inspection comprised 180 inspectors, 5 mining-electrical engineers, and 5 mining-explosives engineers. During the fiscal year, they made exactly 3,985 regular inspections and 629 special inspections. Numerous special checks and surveys were made, and dozens of reports describing conditions in mines and making specific suggestions for correcting hazardous practices and conditions were prepared. Ventilation, timbering, haulage, blasting, rock dusting, gas conditions, electrical installation, and many other phases of mine operation were included in the examinations.

Mandatory compliance with the safety code resulted in substantial improvements in conditions. Appraising, in general, some of the tangible results, it is significant that in the last 3 months of the fiscal year, compliance with code provisions in mines was estimated at 48 percent. Bureau records of some of the major accomplishments reveal that roof-fall hazards were eliminated by improved timbering in 787 mines; ventilation improvements were made in 955 mines; permissible explosives replaced dangerous black blasting powder in 199 mines; 399 mines were rock-dusted for the first time, and 759 partly rock-dusted mines were brought up to standard; smoking was discontinued in 235 mines; and open lights were discontinued in 160 mines.

Safety work.—The Bureau trained 29,988 persons in first-aid and mine rescue work during the year, bringing to 1,674,641 the total number of people trained in such courses since the establishment of the Bureau in 1910. In addition, the Bureau awarded certificates to 45 mines and plants for instructing all employees in first aid and assisted in 32 first-aid and mine rescue contests in 11 States.

At virtually all major mine disasters, Bureau men helped in dangerous rescue and recovery operations. Bureau engineers investigated 47 explosions and mine fires and 84 miscellaneous accidents during the year. Four major disasters—those in which 5 or more men were killed—took the lives of 144 men in bituminous-coal and anthracite mines. In the previous year, only 3 major disasters occurred, killing 51 men.

Offering courses in accident prevention for both metal and coal mines, the Bureau instructed 1,055 workers and officials in the prevention of metal-mine accidents, 125 in the prevention of coal-mine accidents, 1,036 in the safety course for coal miners, 271 in the safe use of explosives, and 758 persons in the petroleum-gas course.

With roof-fall accidents responsible for more than half the deaths in mining industries, renewed interest was shown in preventing such accidents in both coal and noncoal mines. Although progress has been made in reducing roof-fall accidents in coal mines, the accident rate in metal mines has been at a standstill, and the Bureau concentrated its efforts to eliminate roof-fall accidents in these mines.

In answer to requests, the Bureau conducted electrical surveys in noncoal mines, investigated hydraulic and dredging mining operations, and made available to manufacturers and the public much information on the dust-explosion hazards of various commercially developed products.

Testing new electrical mine equipment, the Bureau approved 26 complete units for use in gassy coal mines and, after 1,553 explosion tests, approved 25 separate explosion-proof parts for use on permissible equipment. Further research was done on an emergency mine-communication apparatus for rescuing trapped men, and several investigations were made for the Navy Department.

In the anthracite region, the Bureau studied the practicability of several construction projects designed to prevent disasters from inundation of mine workings, permit mining of large anthracite reserves, and continue active mining operations now threatened with steadily mounting costs due in part to handling water.

Following the revival of activities of the Joseph A. Holmes Safety Association, Bureau personnel made safety awards to numerous plants, supervisors, and individuals in all branches of the mineral industries, and attended and addressed many meetings of the association.

Health work.—In helping to provide healthful working conditions in the mineral industries, the Bureau analyzed 16,000 gas and dust samples taken from various types of mines, made 105,000 individual determinations on these samples, and informed mine operators of their hazards and ways to eliminate them through effective ventilation, air conditioning, and the use of water to allay dust. Progress was made in developing a rapid field method for determining dust hazards and in studying the composition of a wide variety of dusts through X-ray diffraction analysis.

For individual protection against noxious gases, dusts, and fumes, the Bureau provided much information on the proper selection and use of respiratory protective devices and conducted laboratory studies in connection with the approval of new equipment. Proving beneficial to mine operators, considerable information was supplied on mine and tunnel ventilation, heat and moisture changes in air-flow circuits in hot, deep mines, and acid mine drainage.

In cooperation with the Navy Department, the Bureau conducted tests to determine the accuracy of certain gas-indicating instruments under various conditions. Testing the use of Diesel locomotives underground, the Bureau found that toxic constituents created in the atmosphere could be readily diluted and made harmless through adequate ventilation.

Economics and Mineral Industries

Through the economic and statistical services of the Bureau of Mines, basic information on foreign and domestic mineral resources essential to a peacetime economy and vital in an emergency was supplied to the Government, mineral industries, and the public. Numerous periodical reports on domestic mineral statistics and the international trade in minerals were published, including the Minerals Yearbook, long recognized as the outstanding authority on the Nation's mineral resources. Confidential wartime reports on metals were redesigned for general release, and a 40-year production record of the Tri-State lead-zinc mining district was published. Much information was released on strategic nonmetallic minerals, on nonmetallic construction materials, on potash and phosphate, and on limestone utilization. Monthly Mineral Trade Notes and five reviews of major developments in the nonmetallic industries were compiled and issued. Information on the production, distribution, and consumption of petroleum and natural gas at home and abroad was released. Many reports on coal were prepared and released, including special research in the expanding American coal export market of importance to the European rehabilitation program. Foreign mineral investigations were conducted in Brazil, and plans were formulated for assigning mineral reporting specialists to the United States Foreign Service. Numerous statistics on injuries in mines and plants were compiled, as well as information on the record participation of 641 mineral operations in the National Safety Competition for 1947. Bureau commodity specialists participated in many interdepartmental mineral activities, served on committees of the Army-Navy Munitions Board, and attended international conferences on tin at London and Brussels and the Second Pan-American Congress of Mining Engineering and Geology in Brazil. Although the Bureau received increasing demands for economic and statistical information on mineral resources, some valuable reports and services were curtailed or stopped during the year owing to a reduction in funds.

Metals.—Reorienting economic and statistical information on metals to the peacetime needs of Government, Congress, and industry, the Bureau redesigned several confidential wartime reports for general release, simplified some very detailed reports, and reduced other reports from monthly to quarterly frequency. Reviewing wartime reports on foreign metals, compiled by other Government agencies, the Bureau published items of public interest as special supplements to the Mineral Trade Notes—short monthly reports on foreign mineral developments. Of value to lead-zinc operators now faced with a serious shortage of these metals, the Bureau released a special report on the production record of the Tri-State mining district of Kansas, Oklahoma, and Missouri, based on 40 years of records collected by the Metal Economics Division at Joplin, Mo. In addition, 5,390 requests for information on metals were received and answered by the Bureau, and comprehensive up-to-date data on source material were made available to the public for special studies. Under the Strategic and Critical Materials Stock Piling Act, Bureau specialists on metals also served on the Army and Navy Munitions Board's strategic materials and interagency advisory committees concerned with industrial mobilization planning and the stock piling of strategic minerals.

Nonmetallics.—As a guide in determining strategic domestic natural resources needed in an emergency, the Bureau offered much information on many important nonmetallic minerals, including quartz, mica, asbestos, industrial diamonds, and monazite. To aid the material-short construction industry in a solution of the Nation-wide housing problem, essential data on nonmetallic mineral building materials were made available to the public. Shortages of such commodities as cement and gypsum were common, and Bureau statistical reports proved valuable to both Government and industry. Basic statistics on other nonmetallic mineral products, such as potash, phosphate, sulfur, salt, and lime, also were compiled and released. Twenty-one commodity chapters, comprehensive reviews outlining economic and technical developments in the mineral industries, were completed and published in the Minerals Yearbook. To answer many questions received from producers, consumers, and the general public, information circulars were prepared and released on limestone usage, insulating materials, and tripoli, as well as monthly Mineral Trade Notes. In addition, five general reviews of major developments in the nonmetallic industries were compiled for the technical press, and papers were presented before technical and trade associations on the use of blast-furnace slag, German clays, and mineral pigments.

Petroleum and natural gas.—Interest in current Bureau statistical and economical reports on oil and natural gas increased during the past year as domestic demands for these commodities exceeded all previous records and monthly oil imports topped exports for the first time. The Monthly Petroleum Statements supplied information on all phases of domestic oil supply and demand by major product, and the Monthly Forecast Reports gave estimates of the crude-oil requirements by States of origin. While forecast reports were frequently revised by the Bureau to meet the sharp upward trend in demand, they presented accurate data on existing requirements. Additional facts on the production and use of liquid products derived from natural gas were included in the Monthly Natural Gasoline Reports, and information on oil production, distribution, and consumption in foreign countries were made available through the Monthly International Petroleum Trade Reports. In the past year, trends in the domestic demand for oil were affected by progress in manufacturing automobiles, installing new oil-heating units, and shortages in other fuels at home or abroad.

Coal.—In coal economics, the Bureau conducted numerous statistical and economic studies and prepared many reports pertaining to the production, distribution, requirements, consumption, and use of bituminous coal, anthracite, lignite, coke, and other solid fuels. The reports covered trends in coal mining and preparation methods, together with information on markets, prices, and transportation problems. Statistics on coal proved useful to the Solid Fuels Administration for War, Coal Mines Administration, Office of Price Administration, and Civilian Production Administration in connection with maintaining an equal distribution of existing fuel supplies in times of regional, industrial, and domestic shortages. As an aid to the European recovery program, considerable information was made available on the expanding American coal export market. Information on special-purpose coals also was supplied the gas and steel industries. In addition, special research on coal was conducted for Congress, the press, and business services, and the standard weekly, monthly, quarterly, and annual reports on solid mineral fuels were continued, with increasing demands for these reports from the mining industries and the general public.

Foreign minerals.—Under the auspices of the Interdepartmental Committee on Scientific and Cultural Cooperation, the Bureau continued foreign mineral investigations in Brazil throughout the year. At the request of Bolivia and Mexico, Bureau specialists in foreign minerals were assigned to these two countries to study and recommend long-term programs of technical cooperation. Bureau specialists also attended the Second Pan-American Congress of Mining Engineering and Geology at Petropolis, Brazil. The Director of the Bureau of Mines was one of three official United States delegates at the Congress. Eleven American republics and Canada were represented. To formulate plans for assigning mineral reporting specialists to the United States Foreign Service, under Public Law 724, approved August 13, 1946, Bureau specialists conferred with officials of American embassies in Brazil, Argentina, Chile, Bolivia, Peru, and Mexico. Hitherto unavailable information also was obtained on Mexican mineral resources. In the Foreign Mineral Survey series, only one report, covering the mineral resources of the Belgian Congo, was published during the year, but manuscripts on China and Belgium were completed.

Accidents and employment data.—Safety of workers in the Nation's mines and industrial plants continued to be of prime importance to the mineral industries and Government as four major coal-mine explosions increased the demand for the Bureau's injury statistics in the fiscal year 1946–47. Following the coal-mine disaster at Centralia, Ill., many special tabulations of injury statistics were supplied to congressional committees, Government agencies, employee unions, mine operators, and newspapers and magazines interested in studying and promoting safer operating conditions in the Nation's mines. Despite the urgent and expanding need for injury statistics, lack of adequate funds during the past two fiscal years caused a 50-percent reduction in personnel assigned to this work. The record enrollment of 604 mineral operations in the Bureau's National Safety Competition for 1946 was surpassed in the 1947 contest, with the participation of 641 plants and mines, including coal, quarry, and metal operations. Certificates of honor for outstanding safety work were presented to 1,593 individual miners, and certificates of honorable mention were awarded to 90 mines and quarries.

Public Reports

The volume of publications prepared and issued by the Bureau of Mines was increased by more than 23 percent last year in response to a rising demand from industry, Government agencies, and the public for informative material on subjects associated with the mineral industries. Much of this demand was attributed to an intensified interest in the status of the Nation's mineral reserves and a growing awareness of their importance to economic and military survival.

Many technical papers and reports withheld during the war were released for publication. Most of these dealt with mineral surveys, but an even greater part of the increased volume of work arose from requests by national technical societies and the technical press for speeches and articles by Bureau staff members.

In summary, 704 manuscripts were handled as compared with 541 during the previous year. These included 64 chapters for the Minerals Yearbook, 206 reports of investigations, 57 information circulars, 323 speeches and articles for the technical societies and press, and 54 miscellaneous printed and processed publications. This required the editing of 22,445 pages of manuscript and the preparation of 3,175 illustrations, as well as reading galley and page proofs and compilation of indexes.

Responsible for keeping the minerals industry and the public informed of trends and developments in mining, metallurgy, health and safety, and related fields of activity, the Bureau disseminated its technologic, scientific, and economic information among those to whom it would be of value. However, the number of copies of each publication printed and distributed was held to a minimum to make available funds go as far as possible.

During the year, 3,694 books and pamphlets were added to the Bureau's Washington library of selected reference material, which now contains 68,755 items. As the year ended, 450 periodicals were being received and recorded, including the 239 regularly circulated to staff members as soon as received. For use outside the library, 21,978 books and periodicals were loaned or routed. There were 4,270 inquiries by telephone, and more than 4,600 persons came to the library to use its facilities.

Showings of Bureau of Mines educational films increased 20 percent over the previous 12 months and more new films were acquired than in any similar period in the past 6 years. These films, produced under the supervision of the Bureau and paid for by private industry, were screened 111,168 times before audiences totaling more than 8,000,000 persons. Containing no advertising and mentioning the sponsor's name only at the beginning and end of each picture, they are distributed free of charge for showing before school, college, and vocational training classes, engineering and scientific societies, and business and civic organizations.

With one exception, more new film prints—1,064 copies—were added to the Bureau's motion-picture library than in any other fiscal year, bringing the total in circulation to 5,646 copies and the footage to 4,820,607. Industry's contributions exceeded $400,000. Nine new films were obtained. In 16-millimeter sound, they were: The Drama of Steel, The Story of Nickel, The Story of a Storage Battery, Oklahoma and Its Natural Resources, This Is Aluminum, and four films on brazing and the various methods of welding aluminum. State films on the mineral resources of California and Ohio are in production. The first all-color film made under the Bureau's supervision, Sulfur, was completed toward the end of the year.

Administration

During the year, central administrative units have been established at the larger field stations of the Bureau in order to handle the routine work of the Bureau more efficiently. As in past years, activities of the Bureau of Mines were administered from Washington, D. C., but were carried on largely in the field offices, laboratories, and pilot plants.

Personnel.—On June 30, 1947, there were 2,862 full-time employees in the Bureau of Mines, distributed as follows:

Classification and number of appointees, June 30, 1947

	P&S	SP [1]	CAF	CPC [2]	Total
Department	106		335	8	449
Field	791	312	623	687	2, 413
Total	897	312	958	695	2, 862

[1] Includes instrument makers, safety instructors, laboratory aids, assistants, etc.
[2] Includes laborers, mechanics, messengers, wage employees, etc.

Property.—As of June 30, 1947, the property of the Bureau had a total valuation of $16,862,208.22, of which $1,480,401.94 was for land and $5,726,820.73 for buildings and improvements; $3,382,804.37 for laboratory equipment; $2,969,173.03 for machinery and power-plant equipment; and the remainder for automobiles and trucks, office furniture and equipment, rescue equipment and specialized apparatus, and other goods.

Finance.—The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1947, including direct appropriations, departmental allotments, reappropriated balances, and sums transferred from other departments for service work, were $26,052,579. Of this amount $15,938,570 was spent, leaving an unexpended balance of $10,114,009. On the regular work of the Bureau, $14,885,652 was expended. These figures are subject to revision because of unpaid obligations.

Table 1 presents classified information regarding the financial history of the Bureau for the fiscal years ended June 30, 1944–47.

Table 2 gives a statement of the distribution of congressional appropriations to the services and divisions, and the expenditure of these funds in 1947 by Bureau divisions.

TABLE 1.—*Bureau of Mines appropriations and expenditures, fiscal years ended June 30, 1944–48*

Fiscal year	Appropriated to Bureau of Mines	Departmental allotments [1]	Funds transferred from other departments [2]	Total funds available for expenditures	Unexpended balances	Total expenditures	Expenditures, exclusive of service items [3]
1944	$20, 969, 098. 00	$91, 300	$3, 460, 898. 00	[4] $25, 476, 222. 00	[5] $5, 654, 660. 00	$19, 821, 562. 00	$17, 962, 090. 00
1945	22, 195, 136. 55	91, 500	6, 260, 167. 74	[5] 28, 988, 520. 00	[6] 8, 556, 166. 67	20, 432, 353. 33	19, 656, 644. 67
1946	17, 846, 838. 69	[7] 6, 500	2, 384, 271. 00	[6] 25, 301, 457. 69	[8] 8, 050, 809. 69	17, 250, 648. 00	16, 009, 760. 00
1947	16, 000, 515. 00	[7] 7, 800	1, 641, 243. 47	[8] 26, 052, 579. 00	[9] 10, 114, 009. 00	15, 938, 570. 00	14, 885, 652. 00
1948	12, 285, 800. 00	[7] 6, 000	1, 164, 652. 00	[9] 19, 958, 440. 00			

[1] Includes printing and binding, stationery, and contingent funds.

[2] Includes proceeds from sales of residue gas.

[3] Service items include helium and other investigations and services for other departments.

[4] Includes $4,606,720.72 unexpended balance reappropriated, and balance of $202,723.66 receipts from sale of helium and other products.

[5] Includes $4,603,644 unexpended balance reappropriated, and balance of $291,152 receipts from sale of helium and other products.

[6] Includes $4,678,164 unexpended balance reappropriated, and balance of $385,684 receipts from sale of helium and other products.

[7] Includes stationery and contingent funds.

[8] Includes $3,176,386.12 unexpended balance reappropriated, and balance of $457,684 receipts from sale of helium and other products.

[9] Includes $6,501,988 unexpended balance reappropriated, and balance of $800,727 receipts from sale of helium and other products.

TABLE 2.—*Bureau of Mines expenditures, fiscal year 1947*

Division or branch	Salaries and expenses	Operating rescue cars and stations and investigation of accidents	Coal-mine inspections and investigations	Testing fuel	Anthracite investigations	Construction and equipment of anthracite research laboratory	Synthetic liquid fuels	Mineral mining investigations	Investigation and development of domestic mineral deposits	Coal investigations	Oil and gas investigations
Office of the Director	$36, 594										
Office of Minerals Reports	2, 524	$32, 879	$55, 326	$45	$3, 656		$63, 735		$38, 476	$3, 285	$12, 741
Total	39, 118	32, 879	55, 326	45	3, 656		63, 735		38, 476	3, 285	12, 741
Administrative Service	91, 890	17, 925	24, 270	39, 343	1, 635		183, 859	$21, 796	59, 709	15, 899	36, 863
Mining Branch	1, 922							233, 024	1, 284, 967		
Metallurgical Branch	6, 641							239, 926	307, 662		
Fuels and Explosives Branch:											
Coal Division	3, 182	124, 010	65, 532	316, 494	62, 102		185, 344			327, 497	
Explosives Division		290, 412									
Fuels Utilization Division	3, 203			143, 472							
Petroleum and Natural Gas Division	892						1, 738, 588				776, 614
Synthetic Liquid Fuels Division							1, 086, 270				
Total	7, 277	414, 422	65, 532	459, 966	62, 102		3, 010, 202			327, 497	776, 614
Economics and Statistics Branch:											
Coal Economics Division	484										
Foreign Minerals Division											
Metal Economics Division	40, 191										
Accident Analysis Division	2, 820		15, 189								
Nonmetal Economics Division	601										
Petroleum Economics Division	79										
Total	44, 175		15, 189								
Health and Safety Branch:											
Coal Mine Inspection Division	1, 064		1, 237, 927								
Safety Division	4, 582	481, 355	20, 618		30, 842						
Health Division	270	70, 570	73, 212								
Total	5, 916	551, 925	1, 331, 757		30, 842						
Total appropriations	197, 400	1, 019, 000	1, 494, 900	500, 600	99, 000	$450, 000	9, 759, 784	496, 850	1, 700, 000	350, 000	826, 750
Total expenditures	196, 939	1, 017, 151	1, 492, 074	499, 354	98, 235		3, 257, 796	494, 746	1, 690, 814	346, 681	826, 218
Balances	461	1, 849	2, 826	646	765	[1] 450, 000	[2] 6, 501, 988	2, 104	9, 186	3, 319	532

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[1] Reappropriated in Interior Department Appropriation Act, 1948.

[2] Available for expenditure in fiscal year 1948.

TABLE 2.—*Bureau of Mines expenditures, fiscal year 1947*—Continued

Division or branch	Expenses mining experiment stations	Metallurgical research and pilot plants	Care, etc., buildings and grounds, Pittsburgh, Pa.	Economics of mineral industries	Construction and equipment of helium plants	Helium utilization and research	Helium production	Development and operation of helium properties (special fund)	Salaries and expenses, Solid Fuels Administration for War	Reduction of zinc concentrates with methane gas	Drainage tunnel, Leadville, Colo.
Office of the Director											
Office of Minerals Reports	$9,500	$15,803		$291							
Total	9,500	15,803		291							
Administrative Service	70,536	36,501	$212,592	47,461		$4,762	$26,512	$2,723	$13,064		
Mining Branch	282,781										$33,760
Metallurgical Branch	997,956	945,412								$2,769	
Fuels and Explosives Branch:											
Coal Division	67,751										
Explosives Division											
Fuels Utilization Division											
Petroleum and Natural Gas Division					$921,326	94,748	431,643	158,509			
Synthetic Liquid Fuels Division											
Total	67,751				921,326	94,748	431,643	158,509			
Economics and Statistics Branch:											
Coal Economics Division				397,782					236,754		
Foreign Minerals Division				59,843							
Metal Economics Division				169,447							
Accident Analysis Division				59,467							
Nonmetal Economics Division				77,650							
Petroleum Economics Division				60,953							
Total				825,142					236,754		
Health and Safety Branch:											
Coal Mine Inspection Division											
Safety Division											
Health Division											
Total											
Total appropriations	1,430,615	1,000,000	213,000	873,000	1,972,133	100,000	1,132,264	961,959	250,000	3,182	37,381
Total expenditures	1,428,524	997,716	212,592	872,894	921,326	99,510	458,155	161,232	249,818	2,769	33,760
Balances	2,091	2,284	408	106	1,050,807	490	674,109	[2] 800,727	182	[2] 413	[2] 3,621

Division or branch	Missouri River Basin (reimbursable)	Cooperation with the American Republics	Working funds	Contingent expenses	Total
Office of the Director					$36, 594
Office of Minerals Reports					238, 261
Total					274, 855
Administrative Service	$10, 320			$7, 203	924, 863
Mining Branch	87, 815		$35, 919		1, 960, 188
Metallurgical Branch			30, 323		2, 530, 689
Fuels and Explosives Branch:					
Coal Division			7, 028		1, 158, 940
Explosives Division			135, 138		425, 550
Fuels Utilization Division					146, 675
Petroleum and Natural Gas Division			84, 815		4, 207, 135
Synthetic Liquid Fuels Division					1, 086, 270
Total			226, 981		7, 024, 570
Economics and Statistics Branch:					
Coal Economics Division			129, 172		764, 192
Foreign Minerals Division		$41, 397			101, 240
Metal Economics Division					209, 638
Accident Analysis Division					77, 476
Nonmetal Economics Division					78, 251
Petroleum Economics Division					61, 032
Total		41, 397	129, 172		1, 291, 829
Health and Safety Branch:					
Coal Mine Inspection Division			1, 587		1, 240, 578
Safety Division			9, 549		546, 946
Health Division					144, 052
Totals			11, 136		1, 931, 576
Total appropriations	155, 088	41, 481	980, 992	7, 800	26, 052, 579
Togal expenditures	98, 135	41, 397	433, 531	7, 203	15, 938, 570
Balances	[2] 56, 953	84	[2] 547, 461	597	10, 114, 009

[2] Available for expenditure in fiscal year 1948.

Solid Fuels Administration for War

DAN H. WHEELER, DEPUTY ADMINISTRATOR

THIS is the final report of the Solid Fuels Administration for War and marks the end of the Government's controls on the distribution of bituminous coal, anthracite, domestic coke, and other solid fuels. These controls were established on April 19, 1943, by Executive Order No. 9332 under the authority of the Second War Powers Act.

Controls were continued the first year following World War II to stabilize and safeguard coal distribution during the reconversion period.

Plans were made to liquidate the agency in the spring of 1946, but a long strike in the bituminous industry brought the need for continuing controls, and funds were appropriated to carry on the work. This action was supported by the coal industry and consumers. The necessity for providing great quantities of coal for the liberated nations without affecting United States economy was another impelling reason for control.

Controls were finally lifted on March 31, 1947, and the President on May 6 issued Executive Order No. 9847 ordering termination of the agency on June 30. Pending administrative matters were transferred to the War Agency Liquidation Unit of the Secretary's Office.

PROBLEMS OF 1946–47

Two urgent problems faced the agency during the summer of 1946: That of moving adequate coal to the Great Lakes areas during the navigation season; and of finding sufficient coal in surplus to export to Europe. There was also the problem of rebuilding American stock piles, depleted because of the suspension during the spring. An acute shortage of high-grade Southern Appalachian coals made it necessary to provide retail dealers with sufficient stocks to carry them through the winter. Export of these coals was not permitted. In June 1946 a regulation covering the distribution of eastern coals was issued. Shipping strikes on the Great Lakes, a strike of offshore seamen, and a strike of coal miners in November and December interrupted the distribution pattern set up under the regulation and emergency distribution regulations were necessary in each case.

It was not until February 5, 1947, that the supply situation was sufficiently improved to warrant revocation of specific distribution regulations on bituminous coal. After that date distribution to United States consumers was controlled by special directions as the need arose. Regulations governing exportation of coal were continued until March 31.

REQUIREMENTS

Production losses because of the spring strike in 1946 were estimated at 81,500,000 tons. When the strike ended, an inventory indicated that 516,500,000 tons would be required to be produced between June 1 and the following March 31. This called for an annual production rate of 620,000,000 tons, equal to that of 1944, the highest during any of the war years. Stock piles were dangerously low, this shortage being further emphasized by the strike in the fall.

On October 25, it was estimated that Great Lakes shipments were short 5,000,000 tons of their quotas of Southern Appalachian coal and that all Lake shipments were 25 percent behind the 58,002,400 tons scheduled. Anthracite commercial requirements were estimated at 56,900,000 tons.

REGULATION AND DIRECTION

Four regulations and six orders were in effect at the beginning of the fiscal year. These all pertained to the distribution of bituminous coal and were confined to eastern-mined coals. There were no regulations covering the general distribution of anthracite, domestic coke, and processed fuels, except those requiring filing of reports and authority to divert shipments in emergencies.

In order to assure adequate stocks of coal for the Great Lakes, a regulation issued on June 28 established a series of priorities to provide for equitable distribution of coal produced. Consumers who depended largely or entirely upon water-borne coal were given first preference, retail dealers were given second preference, while third preference was assigned to general industries, permitting them to receive sufficient coal to maintain necessary operations, but not to allow excessive stock piling until more coal was available for movement by rail after the close of the navigation season. This regulation was amended in September to permit increased quotas for retail dealers in Southeastern States when surplus district 7 and 8 coal was available. The regulation was further amended in October, prohibiting transfers of tonnages from one dealer to another, except in certain circumstances in case of World War veterans who were entering the retail coal business. During the several interruptions in production and transportation caused by strikes, interim regulations were issued to cover the emergencies.

THE AUTUMN STRIKE

The second general bituminous mine strike beginning on November 20 and continuing until December 7 resulted in a production loss of 25,000,000 tons, bringing the potential loss in production for the coal year to 106,500,000 tons. The day before the strike started, SFAW issued an emergency regulation freezing one full day's production at the mines, in transit to or at loading ports and on receiving docks at the Great Lakes. Distribution of the frozen stocks was confined to essential users only. Approximately 3,000,000 tons were thus made available for the most critical needs of the Nation.

On November 24, the Secretary called on the States to set up fuel-conservation agencies and called on State and municipal officers to conserve available stocks "by dim-out, closing or restricting amusement places, closure of schools, curtailment of power for industry" where the communities were without sufficient stocks of coal to protect household consumers and essential users such as hospitals, public services, and food processing plants.

The end of the strike on December 7 made unnecessary the carrying out of another issued regulation providing redistribution of excess stocks of coal held by suppliers of electricity to other utilities with less than 30 days' supply and to railroads and other essential users with less than 10 days' supply. An interim direction issued the day after the close of the strike provided for the orderly restoration of normal distribution and on December 11 this direction was amended to permit shippers who filled commitments to preference groups to ship excess tonnage to other consumers. The interim direction was revoked on January 9 and controls in effect prior to the strike were continued in effect until February 5, 1947, when all detailed regulations, except as to exports, were revoked.

ANTHRACITE

Distribution problems in the anthracite field were few and were taken care of in the field offices. Fine sizes were in surplus supply and available for export. Production was high and uninterrupted except for an 8-day suspension in the spring during the contract negotiations. It was unnecessary to issue a freeze order during the suspension and except for the power to issue specific directions as needed and an order requiring the filing of distribution reports there were no regulations in effect.

STOCKS AND CONSUMPTION

Bituminous coal stocks at the beginning of the fuel year, April 1, 1946, were estimated at 58,531,000 tons, having been built up from 45,665,000 tons on January 1 in anticipation of a strike. By May 1, stocks had been reduced to 38,741,000 tons and by June to 31,643,000. The build-up during the summer was slow but by November 1, 54,924,000 tons were in consumers' hands, although unevenly distributed. The November-December strike reduced these stocks to 52,429,000 on December 1 and to 47,157,000 tons on January 1. By the beginning of the 1947 fuel year, stocks were 51,674,000 tons. Consumption for the last half of 1946 was 261,639,000 tons, an increase of less than 1 percent of the burn during the last 6 months of 1945. Consumption during the 1946 calendar year was 498,917,000 tons, or about 11.6 percent less than 1945 consumption and 15.6 percent below 1944.

FOREIGN EXPORT PROGRAM

A demand for American coal by the liberated nations of Europe followed immediately after the surrender of Germany and SFAW in cooperation with other governmental agencies quickly established a program for shipments of available surplus coal. Export of metallurgical and byproduct coal was prohibited, but strenuous efforts were made by SFAW constantly to improve the quality of the coal permitted to flow into the export market. In June of 1946, a statement of policy was issued calling shippers' attention to the fact that only coal of merchantable quality would be authorized for shipment and proximate analyses of coal offered for shipment in export were required. The bulk of the export coal until July 1946 was purchased through the facilities of the Treasury Department. At this time there was announced a gradual change in policy permitting the procurement of coal for export from the Treasury Department to an exclusive commercial program, whereby foreign nations could purchase coal direct from American shippers. The transition in the method of purchase extended over a period of 8 months and was completely effectuated on March 31, 1947. Despite strikes, adverse weather conditions and limited loading facilities, a substantial amount of coal was exported, the total amount from August 1945 until June 30, 1947, being 33,593,468 gross tons going to the liberated areas of Europe and Italy and an additional 6,800,782 gross tons to other European countries and Africa. During the coal year April 1946–March 1947, a total of 14,994,078 gross tons of solid fuels were shipped to the liberated nations and 3,024,947 gross tons were exported to other European countries, making a 12-month total of 18,019,025 gross tons. In addition, South American and trans-Pacific areas were exported a total of 4,679,121 gross tons, between August 1945 and June 30, 1947. These figures do not include shipments to Canada.

PROCESSING OF STATISTICS

As in previous years, there was included in the appropriation for SFAW a sum to be allocated to the Bureau of Mines for the processing of all statistical data required by SFAW in the discharge of its regulatory responsibilities. Data received by SFAW were turned over to the Bureau for compilation and analysis.

COOPERATION OF THE COAL INDUSTRY

The Secretary of the Interior has many times expressed to the coal industry as a whole, and separately to organizations and individuals within the industry, his appreciation for the cooperation extended the Government in its labors of regulating the distribution of solid fuels. It is proper to record here again a tribute to the industry and its component parts for this indispensable assistance. Informed counsel was always and unstintingly available for the solution of any problem. All regulations were formulated with the help of such counsel. Once formulated they were administered with the aid of the industry. Violations of a major character were few, compliance was general and litigation negligible in comparison with the magnitude of the job.

LITIGATION PENDING

The United States Circuit Court of Appeals, Second Circuit, New York, on April 18 remanded for a new trial a criminal case in which an anthracite wholesaler was convicted of violating regulations in 1945. By a two-to-one decision, the court held that the delegation of power to the President under the Second War Powers Act, his redelegation to the SFAW, and the promulgation of the anthracite regulations were lawful, and that the information filed against the wholesaler stated facts sufficient to constitute a crime; but remanded the case for a new trial because of error by the trial court in excluding evidence offered by the wholesaler in an attempt to prove that the transactions complained of were not prohibited by the regulation. Other criminal informations were pending against three anthracite wholesalers, including the same defendant in the New York case. Disposition of these matters will be made by the Department of Justice.

FINAL ORDERS ISSUED

Two orders were issued on May 14, one dissolving the Solid Fuels Administration for War producers' advisory boards, the other dissolving remaining functional councils, boards, and committees.

Advisory boards were directed to proceed to wind up their affairs and to transmit to SFAW at Washington, before June 30, all original records, such as minutes and records relating to actions taken with respect to fiscal affairs, production and distribution. The second order dissolved the following: The Solid Fuels Advisory War Council; the Lake Dock Coal Advisory Committee and the Tidewater Dock Coal Advisory Committee; the several SFAW area advisory committees on local distribution; the several SFAW community committees on emergency distribution; the SFAW National Advisory Coke Committee; the National Anthracite Distribution Committee and the several regional anthracite distribution committees; and any and all other advisory or functional committees and all subcommittees appointed by any of the aforesaid committees.

LIQUIDATION OF SFAW

Liquidation of the agency was carried out according to plan, with all functional activities being discontinued on March 31. Services of employees in field offices and most of those in Washington were discontinued on April 30. Closing of field offices and disposal of their records were carried out during April. A similar program was carried out in Washington during April, May, and June, the major portion of the work being accomplished by June 30. However, according to the liquidation plan, approved in principle by the Congress when it included the requested $60,000 for the purpose in the Interior Department Appropriation Act of 1948, an administrative staff of 38 employees was transferred on July 1, 1947, to the War Agency Liquidation Unit of the Secretary's Office for completing the winding-up process and closing the books. This small staff was gradually reduced as liquidation progressed until all had been released or transferred. The liquidation will be substantially completed on October 31, 1947, with only one or two minor matters then remaining for attention.

Geological Survey

W. E. WRATHER, DIRECTOR

EVER since its organization in 1879, the Geological Survey has been an active agent in the conservation of our natural resources. As understanding of the need for conservation has grown, many phases of the work originally carried on by its staff have been transferred to other administrative units, such as the Forest Service of the Department of Agriculture and the Bureau of Reclamation, Bureau of Mines, and Oil and Gas Division of the Department of the Interior. The Geological Survey, however, remains the center of numerous activities concerned with the discovery, evaluation, and development of the Nation's mineral and water resources. During the fiscal year 1947 definite progress was made in embarking upon a long-range program of systematic studies aimed at determining the ultimate capacity of this country to produce the mineral raw materials upon which our vast industrial structure is based.

GEOLOGIC BRANCH

As an answer to the often repeated statement that the United States is rapidly becoming a "have-not" Nation through exhaustion of certain vital mineral resources, the Geological Survey is prepared to show that large areas of potentially rich oil and gas, or mineral-bearing lands never have been adequately explored. To be sure, the surface itself has been rather thoroughly walked out and prospected by the old methods. But below the surface lie enormous volumes of rock, which should contain concentrations of mineral wealth in approximately the same abundance in which they were encountered on the surface. The difference is simply that the buried mineral deposits will be harder to find. The old-time prospector must be aided more and more by geologists, geophysicists, and geochemists to reveal what may lie below the surface by extensive geologic surveys, and other highly refined new techniques. Research along many of these lines was begun or continued during the fiscal year 1947 as outlined in summary reports that follow.

Metals

Metalliferous ore deposits were investigated in many parts of the United States during 1947, with intensive study concentrated in 18 States. Cooperative studies were made, as in previous years, with seven States. In all, 44 major field projects were carried on; of these, 9 were completed. Several field projects which had been recessed because of the war, lack of funds, or unavailability of personnel were resumed. Lead, zinc, copper, and iron continued to receive concentrated attention because of their importance to the national economy. Projects relating to mercury, chrome, and tungsten, which were started as strategic minerals surveys, are being carried on, but on a reduced scale. Comprehensive final reports are being prepared on these subjects. Of the three field projects started last year as part of the Missouri Basin studies, two have been completed and final reports are being prepared on them; field work is continuing on the third project. During the year, eight maps showing mineral deposits were published; three of these were Missouri Basin studies. A total of 13 geologic reports, together with maps, on various metalliferous deposits were published; these included 1 professional paper, 3 bulletins, and 9 reports published by State cooperating agencies. In addition, 6 reports were placed in open file and 12 press releases were issued.

Radioactive Materials

The evaluation of domestic resources of radioactive materials has entailed field work in 12 States and has disclosed much new and valuable information concerning the mode of occurrence, associations, and availabiliy of these materials. Reconnaissance investigations of State-wide areas have successfully delimited local areas in which detailed study was warranted. Several such local areas were examined.

Research on geophysical and geochemical properties of radioactive materials has resulted in further refinement of the techniques of exploration and detection. Complex electronic equipment, such as the Geiger-Mueller counter with its associated recording devices, has been further adapted to field investigations and to precise laboratory measurements. New methods and techniques of chemical analysis have been developed and successfully used in the precise determination of radioactive elements in all types of material.

Long-range research on the properties of radioactive materials was begun to obtain the basic data necessary for a complete and accurate evaluation of the domestic resources of such materials and for establishing the factors controlling their occurrence. This program has continuing value because the new uses for radioactive material, either actual or potential, make it imperative that we adequately appraise our domestic resources within the near future.

Nonmetals

The Nonmetals Section completed field investigations of corundum in Montana; magnesite in Nevada and Washington; high-alumina clay in Idaho; fluorspar in the Zuni Mountains, N. Mex., and Eagle Mountains, Tex.; feldspar in New Jersey and North Carolina; and phosphate in the Lander area, Wyoming. A report on the Lander project was prepared and submitted to the Wyoming Geological Survey for publication; reports on the southeastern mica pegmatites, the northwestern clays, and the other projects are in preparation. Continuing projects included investigations of nonmetallic minerals in the Missouri River Basin; potash in the Carlsbad area, New Mexico; alunite in Utah; talc in Vermont and New York; asbestos in Arizona; pegmatites in California, South Dakota, North Carolina, and Maine; clay in Maryland; fluorspar in Kentucky, in the Burro Mountains, N. Mex., and in the Northgate district, Colorado; phosphate investigations in Idaho, Montana, Wyoming, and Utah; and appraisal studies of bentonite deposits in South Dakota, North Dakota, Wyoming, and Montana. Preparations were made for field investigations during the fiscal year 1948 of phosphate deposits in Florida. Maps of Colorado and Wyoming showing deposits of construction materials and nonmetallic minerals were released during the year in connection with the Survey's studies in the Missouri River Basin, and five smaller maps of other States in the region were compiled. Nine geologic reports accompanied by maps were published, and three other reports were placed in open files for public inspection. Compilations of data similar to those already prepared for the Missouri River Basin were made for the Columbia River Basin.

Oil and Gas

Intensive efforts continued to be directed toward the accumulation and interpretation of fundamental geologic data necessary to delineate new areas in which the structural and stratigraphic relations are favorable to the occurrence of oil and gas. Such studies were carried forward in 18 States. By maintaining close relations with the oil and gas industry, State geological surveys, and other interested geologic organizations, the Geological Survey has been able to devote its efforts to the study and solution of regional problems of large scope. The policy of publishing preliminary maps and charts embodying the results of field work within a few months after the manuscripts are received in Washington has been continued. During the fiscal year 20 preliminary maps and charts related to oil and gas were printed by the Geological Survey, and about 20,000 copies of these and earlier maps were sold. Total distribution of preliminary maps and charts of oil and gas investigations series begun in 1943 now has reached more than 70,000 copies. An effort is being made to prepare some of the data on oil and gas for more permanent use in the form of bulletins and professional papers of the Geological Survey and as publications of cooperating State organizations, and several such reports were prepared during the year.

Coal

There is urgent need for fundamental studies of the distribution, quality, and quantity of coal available for use as fuel, as a source of chemical raw materials, and as a source material for synthetic liquid fuel. Under available funds it has been possible to continue only a small program of studies of coking and special-purpose coals in Colorado, Montana, Alabama, and North Carolina.

Exploratory Geologic Surveys

The program of systematic exploratory geologic surveys begun in 1946 was expanded during 1947. These surveys provide geologic maps containing basic data useful for a variety of purposes, including appraisal of mineral resources and construction materials, foundation conditions, soil surveys, and ground-water surveys. The program for 1947 resulted in the completion of field work and reports on 17 quadrangles covering a total area of more than 2,100 square miles and the continuation or beginning of field work in 25 additional quadrangles. Several special reports and maps related to regional geologic problems were completed and others were begun.

A large part of the 1947 program was related to the Missouri River Basin development program and was carried on in cooperation with the Bureau of Reclamation. The western part of the Lower Marias irrigation unit was mapped and progress was made on the mapping of the Missouri-Souris and Knife River units. At the present rate of progress the entire Missouri-Souris irrigation area, comprising more than 50 7½-minute quadrangles, will be mapped geologically by 1949 on the scale of 1 mile to the inch. Detailed surveys in the Missouri Basin were supplemented in 1947 by preliminary reconnaissance work on the glacial stratigraphy of western North Dakota and South Dakota, areas for which such stratigraphic data are almost completely lacking. This work, which is of great value in supplying background data for studies of water resources, engineering projects, and detailed geologic work, will be stepped up in 1948.

Field and office work has continued on systematic geologic mapping projects in Tennessee, Texas, and Montana. Field work preparatory to completion of a new geologic map of Montana was continued. Detailed geologic surveys were begun in western Nevada and eastern Utah; these surveys are part of a long-term program planned to provide data on hidden mineral resources in the Great Basin.

A geologic survey of McMinn County, Tenn., was begun in 1947 in cooperation with the Division of Soil Survey, United States Department of Agriculture. Another part of the cooperation with that division is a joint investigation of the properties and origin of some of the agricultural soils in eastern Maryland; this project, in addition to providing a better basis for soil classification, is expected to yield results in the long-neglected border-line field between soil science and geology.

A small program of exploratory geologic surveys in the national parks was begun early in the year, the area studied in 1947 being Great Smoky Mountains National Park, Tenn.-N. C. The purpose of such exploratory surveys is to work out the relationships and structural pattern of the rock formations which can then be used in mapping much of the surrounding region.

Systematic geologic surveys in cooperation with the States of Rhode Island and Massachusetts were continued, and plans were made to increase the rate of progress in these States during the fiscal year 1948.

The program of volcano research in Alaska, sponsored by the War Department, was transferred administratively from the Alaskan Section to the Areal Geology Section, March 1, 1947. This program has yielded much geologic and engineering information.

Geophysics

During the fiscal year 1947 geophysical surveys were made on the ground or from the air by the Section of Geophysics in 20 States, in Alaska, in Antarctica, and in northern Canada. The purpose of these projects is to obtain geophysical information that will aid in the solution of problems of geologic structure, stratigraphy, ground water, permafrost, volcanology, and occurrence of oil and minerals.

Aeromagnetic surveys have assumed an important place in the exploration program of the Geological Survey because of their precision, high speed, and low cost. During the past year 44,539 miles of useful aeromagnetic traverse were flown, covering more than 42,000 square miles in 11 States and in Alaska and Antarctica. Among the major projects are surveys of the southeast Missouri lead belt; the Tri-

State mining district; the Lake Superior iron region; a State-wide survey of Indiana; and surveys of Bikini Atoll and of volcanoes in the Aleutians and Hawaii. The program of volcano research is designed for the eventual purpose of predicting eruptions.

Earth-resistivity surveys to locate ground water or to interpret geologic structure were made in five States, in cooperation with the Water Resources Branch of the Geological Survey. A resistivity survey has also been started at Churchill, Manitoba, to aid in locating a ground-water supply in an area where permanently frozen ground predominates. A start was also made during the past year in compiling deep-well temperature measurements which had been made over a period of several years.

Theoretical studies of magnetic fields were initiated during the year to aid in better utilization of magnetic data and particularly to permit more accurate estimates of the depth to ore deposits and other geologic bodies whose presence is indicated by air and ground magnetic surveys. Theoretical studies were also made of electrical fields and of the flow of current through the ground, to aid in the interpretation of resistivity-depth measurements.

An experimental gravity survey and a program of oceanographic studies were started in June 1947 on the Continental Shelf of the Gulf of Mexico. The program is financed largely by the Office of Naval Research and is being carried out in cooperation with that office and the Woods Hole Oceanographic Institution.

In November 1946 the Division of Geophysical Exploration of the Bureau of Mines was transferred to the Geological Survey and combined with the Section of Geophysics. The former division headquarters in Baltimore, Md., is maintained as a field office of the Geological Survey. The consolidation of geophysical activities of the Department of the Interior in a single section of the Geological Survey has made possible more effective use of geophysics in geological exploration.

During the past half-year the Baltimore field office has been engaged principally on geophysical projects for the Bureau of Mines to which it was committed prior to the transfer. Earth-resistivity, magnetic, and gravimetric surveys were made in eight States, principally in the West, for the purpose of aiding in exploration for copper, lead, iron, mercury, zirconium, and oil. One project, to determine the limits of productive sands in oil fields by geophysical measurements, will continue during the fiscal year 1948.

Geophysical equipment, consisting principally of seismic, resistivity, and magnetic instruments, was constructed in the instrument shop of the Baltimore office. Of special interest is a recently completed

3-component seismograph for quantitative measurement of earth shocks in the Aleutian Islands. The new instrument utilizes a novel method of directly recording time of arrival, amplitude, and frequency of vibrations, in place of the more cumbersome photographic recording devices generally used.

Geochemical Prospecting

Some geologic surveys and investigations are directed toward discovery of new mineral deposits, others toward delineation of the pattern of rock formations so as to facilitate soil surveys or to guide in the selection of routes for highways. All must be supported by active research conducted by such specialists as mineralogists, petrologists, paleontologists, geochemists, and physicists.

One of the most promising pieces of basic research undertaken by the Geological Survey since the war is in the relatively new and little-explored field of geochemical prospecting. Geochemists believe that at the time mineral deposits were formed, small quantities of the various metallic elements were carried out and deposited at considerable distances from the main ore body; since then minute quantities have been finding their way into the ground waters, the soils, and the plants that grow in these soils. Reconnaissance surveys made thus far show that the content of metallic elements in the vegetation, soil, and natural waters is significantly higher in the vicinity of known metalliferous deposits than elsewhere. Such traces can be used as a guide in prospecting if the supporting techniques can be satisfactorily developed. Research was pressed during the year to work out exceptionally sensitive analytical techniques for rapid use in the field. Further critical field tests are planned.

Chemistry and Petrology

Research on the chemical spectrographic and X-ray characteristics of minerals and rocks was unavoidably slowed down during the fiscal year 1947 while the chemical laboratory of the Geological Survey underwent an extensive overhaul, the first since the building was erected in 1918. Only the most urgent research and analytical work was carried on under these difficult conditions, and much of that was devoted to investigations of fissionable raw materials. Petrologic studies of the microscopic characteristics of minerals and rocks, however, were carried on at the normal rate, despite the fact that the closely integrated chemical work had to lag.

Paleontology and Stratigraphy

During the war many of the paleontologists were pressed into other geologic work, particularly that directed toward the search for and evaluation of mineral deposits. During the fiscal year 1947 most of these paleontologists resumed their normal functions—identifying and interpreting in terms of relative geologic age collections of fossils submitted by other units of the Geological Survey, State surveys, and the general public; determining the sequence of rock formations and strata by field studies and by means of the contained fossils; and conducting research on the systematic classification and probable life environment of organisms now known only in fossil form.

Engineering Geology

The group of engineering geologists, with headquarters in Denver, continued its program of supplying background geologic data that can be applied to construction problems by civil engineers or project geologists. Much of the work was done to fit the needs of the Bureau of Reclamation and other agencies concerned with development of the Missouri River Basin, and numerous reports and maps were made available to them in preliminary form. Engineering geologic maps of four quadrangles in North Dakota and five in Montana were completed; maps of an additional four quadrangles in North Dakota and one quadrangle in Washington were begun. Reconnaissance studies of materials suitable for riprap in North Dakota and South Dakota were completed, as were maps of sand and gravel resources in one county in North Dakota and one in Wyoming. Field checking of office-compiled data on the sand and gravel resources of the State of Wyoming were under way. Maps showing the construction materials of four counties in Kansas were completed, and work on several other counties had been begun with the active cooperation of the State Highway Commission of Kansas.

In addition to investigations of the engineering geology of specific areas, such as those noted above, much attention was paid to basic research on geologic problems of wider applicability to engineering. In this category were studies of landslides in Colorado and North Dakota and of mine-water problems in Tennessee and the preparation of an engineering soils map of an area in Virginia, all of which were completed. Work on the engineering soils map and a continuing study of the physical properties of rocks were carried on in cooperation with the Public Roads Administration. Compilation of a dictionary of geologic terms for engineers and of a handbook on drilling from the geologist's standpoint were in progress, with completion expected in 1948.

To fill part of the need for specialized education of engineering geologists within and without the Survey, an intensive 2-week seminar on engineering geology was held during the year. In addition, preparation and distribution of translations and abstracts of foreign literature were continued.

At the beginning of the fiscal year 1948 investigations were being continued along the lines pursued during 1947, and plans were being perfected for studies of the geology and construction materials of Denver and San Francisco and their vicinities and of part of Puerto Rico. The latter project is to be done in cooperation with the Puerto Rico Water Resources Authority. A 20-year plan for work in the Columbia Basin, based on the programs of Government construction agencies, has been completed, and similar outlines for long-range investigations in other areas are being prepared.

Military Geology

The Washington research group of the military geology unit in 1947 prepared 11 comprehensive intelligence reports and 23 shorter reports and bibliographies for the Corps of Engineers. These reports concerned terrain, water supply, construction materials, characteristics of permanently frozen ground, and mineral resources. A special terrain intelligence folio on Fort Knox and vicinity, Kentucky, was prepared at the request of the armored forces and published by the Army Map Service as folio 1 of Terrain Studies in the United States. Work was begun on folio 2 of this series which will deal with Fort Benning, Ga., and the field mapping was about half completed.

The studies of Japanese mineral resources being made by members of the unit assigned to Natural Resources Section, General Headquarters, Supreme Command for the Allied Powers, in Tokyo, were about 90 percent complete at the end of the fiscal year. During the year, 28 bulletins were prepared by this group and published by the Natural Resources Section; they dealt with mineral resources, construction materials, and metallurgy. A similar survey of Korea was completed and its results embodied in a 1,200-page report.

Field work was virtually completed on the geologic map of Okinawa, and mapping was begun in the Palau Islands and on Yap. In the coming year, similar studies will be begun on Guam and possibly on Truk.

A survey was made of Bikini Atoll, to determine the effect of the atomic bomb explosions on the islands, reefs, and lagoon floor. Two reports on the geologic aspects of this work have been completed.

Two geologists participated in a reconnaissance survey of Micronesia for the U. S. Commercial Co. and have prepared reports on the mineral resources and water supply of the area. A geologist and a geophysicist were assigned to the Navy's expedition to Antarctica; four scientific papers have been prepared. One geologist remained on assignment to the general engineer district, Manila, as a consultant on engineering geology and to aid in the rehabilitation of the Philippine Bureau of Mines.

Geologic Investigations in Alaska

The war years have seen a greatly increased public interest in Alaska, which is expressing itself in long-awaited postwar ventures on the part of both private interests and Territorial management. Increasing demands for information are coming from former servicemen and other individuals, from small business, and from large corporations. The future settler in Alaska can be helped immeasurably in planning his new life, and the development of the Territory on a sound basis can be expedited if the Geological Survey and other Government agencies, each in its respective field, are able to supply the needed answers. As a result of its war activities the Geological Survey is better able than at any time in the past to reply adequately to such questions; but far more work is needed to keep pace with the growing demands.

Before the war, emphasis was placed on geologic investigations contributory to the production of gold; during the war it was placed on the development of minerals essential to the war effort; now the emphasis has shifted to a program of diversified mineral production and long-range investigations in areas considered to be potentially valuable as mineral producers.

In October 1946, the Alaskan Branch was dissolved as a major organizational unit of the Geological Survey, and its technical activities were transferred to the appropriate functional branches. A new position, staff geologist, Territories and Island Possessions, had been established in September 1946 to insure the coordination of the various activities of the Geological Survey in Alaska and other possessions. The geologic staff of the former Alaskan Branch was transferred to a newly established Alaskan Section in the Geologic Branch, which has been made responsible for general geologic mapping and studies of mineral resources within the Territory. Studies of volcanoes of the Aleutian arc, radioactive materials, and permafrost, which had been carried on for the Army and Navy, were allocated as of March 1, 1947, to other specialized units within the Geologic Branch that have been engaged in similar activities elsewhere.

During most of the fiscal year 1947 the field work in Alaska was influenced largely by the requirements of the War and Navy Departments. The program of petroleum exploration and mapping in northern Alaska begun in 1944 was continued. Studies were carried on at Mount Pavlof, Umnak Island, and Great Sitkin Island, and reconnaissance surveys were made in the western part of the Aleutian arc, the major purpose of the program being to analyze volcanic phenomena in an effort to avoid danger to life and property through an understanding and ultimately a prediction of destructive activity.

Investigations of mineral deposits exclusive of fuels were carried on largely in southeastern Alaska during the fiscal year 1947. A study of the Juneau gold belt was renewed, a geologic mapping project was continued on Chichagof Island, and a detailed evaluation of the chromium, magnesium, and platinum resources of the basic rocks of Blashke Island was in progress. Another project in the metals program was an investigation of the gold, quicksilver, and antimony deposits in the Kuskokwin area. The nonmetals projects comprised investigations of limestone and gypsum throughout southeastern Alaska, garnet deposits near Wrangell, and andalusite resources on Chichagof Island. Geologic mapping in coal-bearing areas was continued in the west Nenana area, the Matanuska district, and the Jarvis Creek area, and a general reconnaissance was made to cover potentially valuable coal fields elsewhere in Alaska. Investigations for oil in southern Alaska were carried on near Bering Glacier, on the Iniskin-Chinitna Peninsula, and at Wide Bay.

Though many of these deposits have not as yet reached the stage of commercial development, they stand available as sources of raw materials to replenish stock piles that dwindled during the war and to aid in the future development of Alaska. As a result of relatively limited studies, the known reserves of many of the economically important minerals in Alaska have been substantially increased. For example, quicksilver, formerly considered a source of only minor significance, has become one of Alaska's important mineral products. Explorations by Survey geologists have revealed additional coal reserves estimated at millions of tons.

The development of nonmetallic mineral commodities, such as limestone, gypsum, marble and other building stones, clay, sand, and gravel, may make valuable contributions to the establishment of a sound and stable society in Alaska. Alaska's fuel resources, her coal and perhaps petroleum, when adequately developed, may prove sufficient not only for her own needs but to sustain a considerable export trade as well. Many materials now being shipped to Alaska might in the future be obtained from local sources at lower cost and with greater efficiency.

The importance of mineral resources as a factor in the development of Alaska is indicated by the prewar cumulative production of minerals worth more than $800,000,000. In the last prewar year, 1940, the mineral production was the greatest in the history of the Territory. Alaska's mineral resources have been so little tapped, despite the forced production of certain commodities during the war, that any calculation in terms of dollars and tonnage reserves can be at best only a rough approximation. The known value, however, can safely be set at a minimum of several billions of dollars.

Work in Other American Republics

Geologic investigations in Brazil, Chile, Cuba, Ecuador, Mexico, Panama, and Peru were conducted in cooperation with the geological survey of each country, under the auspices of the Interdepartmental Committee on Scientific and Cultural Cooperation of the Department of State.

In Brazil, field work on the stratigraphy of the three Southern States, the barite deposits of Camamú Island, and the magnesite deposits of Bahia and Ceara was completed. An investigation of the great iron deposits of Minas Geraes was begun.

In Chile, field investigations of underground water supplies were continued at the request of the Chilean Government, which carried the expense.

In Cuba, a short field investigation of the mineralogy of the nickel silicates was made, and comprehensive reports on the chromite and manganese resources were completed.

In Ecuador, a reconnaissance field study of the geological environment of the volcano El Sangay was completed.

In Mexico, field work continued on manganese, lead-zinc, and the volcano Paricutin.

In Panama, paleontologic and stratigraphic field studies were completed.

In Peru, a cooperative field investigation of the lead-zinc deposits of a part of the Province of Ancash was begun.

Six training grants were awarded to young geologists from the other American Republics—two from Mexico and one each from Argentina, Brazil, Chile, and Ecuador—funds for this purpose being supplied by the State Department.

Reports on an antimony district and a mercury district in Mexico were published in 1946 as chapters of Geological Survey Bulletin 946, Geologic Investigations in the American Republics. Four reports on previous cooperative investigations of tungsten, tin, mercury-antimony, and coal were published in Spanish by the Mexican Government. A report on a cooperative investigation of a manganese district in Brazil was published in Portugese by the Brazilian Government.

TOPOGRAPHIC BRANCH

Topographic maps are the fundamental base for making studies and presenting facts and basic data concerning the natural resources of our country. The development of our natural resources, the establishment and expansion of our basic industries to utilize this heritage, the institution and maintenance of adequate measures for security and defense, and the vital functions of preserving and ever advancing national health, safety, and economic welfare can result only from orderly and intelligent planning. Adequate topographic maps are essential to such planning.

As one vivid example there is the case of a certain State which had been seeking to attract new industries. Engineers of a large manufacturing concern were sent to investigate the location selected by the State. They were given glowing verbal accounts regarding possible sites, highway systems, access roads, water supply, drainage, and other factors that govern the selection of locations for industrial plants, but there were no available topographic maps which the investigating engineers could use as a basis for thorough study. Interest immediately ceased, the investigators pointing out that they would not even consider a location without topographic maps to yield definite data regarding the configuration of the ground, the courses of streams, routes of roads, railroads, power lines, and collateral information. Their attention was transferred to sites in other States for which topographic maps were available, and the State without maps lost a $10,000,000 industry.

Recommendations are now at hand from the heads of map-using Government agencies and from the various States for the completion of modern topographic maps for the entire United States in a 20-year period. An expanded program has been prepared but awaits the necessary funds. While there is no magic formula by which topographic maps can be produced overnight at bargain prices, tremendous savings would result from initiating a comprehensive mapping plan now, while there is time for orderly planning and execution and before the urgent needs of extensive new construction, natural resource studies, and national defense demand maps produced in a hurry at higher costs. Topographic mapping is a lengthy, painstaking process even with the modern methods now in use. Mapping done under emergency conditions is expensive, the product frequently is unsatisfactory, the maps may be too late to serve pressing needs.

A preliminary consideration in the economical expenditure of public funds for mapping is the selection of areas to be mapped. Analytical studies must be made of the requirements of Government agencies, whose requests are presented through the Bureau of the Budget, and of the mapping needs presented by cooperating State agencies. After the areas have been chosen, proper scale and contour interval must be determined. In many cases it is found that, although existing maps having a scale of 1:62,500 are adequate for general use, they are not suitable for certain special purposes—notably engineering studies—and requests are therefore received for remapping on larger scales.

The development of a national mapping program involves, however, far more study than a mere cataloging of needs presented by public agencies from time to time. With the expansion of the works of man, cultural features are constantly changing; consequently a map that is up to date now may soon become obsolete. Small-scale maps of a sparsely settled area may have been entirely adequate for a time; but when natural development brings heavier settlement, those same maps may quickly become unsatisfactory.

These and other related factors make it vitally necessary that the status of existing maps be reviewed periodically. The results of the latest such review appear on the accompanying map, Status of Topographic Mapping in the United States. As indicated thereon, the area covered by modern topographic maps of standard content, with culture reasonably up to date, is woefully small, less than 25 percent of our country.

During the past year these studies of the status of mapping have been expanded to include available aerial photography of the United States. The map shows areas photographed and those scheduled for new photography. In the numerous cases where there are two or more sets of photographs of the same area, that set judged to be most suitable for general needs has been selected.

Reorganization

Reorganization of the Topographic Branch, which was in the planning stage some months prior to the beginning of the fiscal year 1947, has for the main part become a reality. This realinement resulted in the establishment of two staff divisions—one covering the field of research and technical control; the other including planning, production, and general coordination and liaison. These two divisions are composed of several old established sections augmented by new sections whose duties and accomplishments are stated further on in this report. The former Rocky Mountain Division was reactivated with headquarters at Denver, Colo. The area assigned to this division includes the States of Montana, Wyoming, Colorado, and New Mexico, and the Territory of Alaska. A demand from the military services for continuation of the aeronautical charting compilation done by the Alaskan Branch during the war resulted in the establishment of a special unit, the Trimetrogen Section. This group is engaged mainly in producing aeronautical charts and special maps for the armed forces.

Geodetic Control Surveys

The Section of Geodesy and Control has undertaken as its first responsibility the preparation of new instruction manuals and the revision of existing ones relating to field and office procedure for geodetic control surveys. Included are revised transit-traverse instructions; new instructions for control surveys with level, transit, or theodolite; procedures for surveys to test accuracy of maps; and preliminary studies leading to instructions for supplementary control established with altimeters.

Concurrently, this section is investigating the application of electronics in establishing geodetic control for topographic mapping and is conducting experiments in the use of altimeter surveys also applicable to topographic mapping. Research has been directed toward the development of an assembly of electrical circuits that can be set up and adjusted in such a way as to be analogous to networks of traverse or level lines. Adjustment of surveys by electrical control gives results comparable to those achieved by mathematical adjustment but with less work.

An instrument has been designed to determine mechanically the azimuth or bearing of the North Star, Polaris, at any time and from any latitude. This instrument—named the "Polastrodial"—will considerably reduce routine traverse computations.

As an ever-continuing responsibility the section assists in maintaining uniformity in the control-survey activities of the four field divisions of the Topographic Branch, analyzes technical suggestions for processes and equipment, and cooperates with the Division of Field Equipment regarding design and suitability of field instruments used in extending geodetic surveys.

Computing

The former Section of Computing has been integrated with the Section of Geodesy and Control Surveys during the transition period, but it will cease to exist when the reorganization is completed. A gradual transfer of its functions to other units in the Topographic Branch has been taking place. When the realinement is accomplished, computing will be done in field division offices under only general technical direction from the Washington office. Meanwhile, final computations and listings of results for current surveys not yet taken over by field division offices are made available by the issuance of lithographed lists of bench marks, triangulation stations, and traverse stations for 270 quadrangle map areas of 15-minute size. The transfer of this work to field offices requires the sorting and separation of extensive files of computations and records according to geographic areas; the microfilming, before shipment, of thousands of field notebooks and office computation books; and the indexing of master files of the results of all geodetic surveys accomplished since 1883. The distribution of control data to other Government agencies and to the public became a function of the Map Information Office in November 1946. The transfer of six employees and voluminous files of geodetic data completed this change.

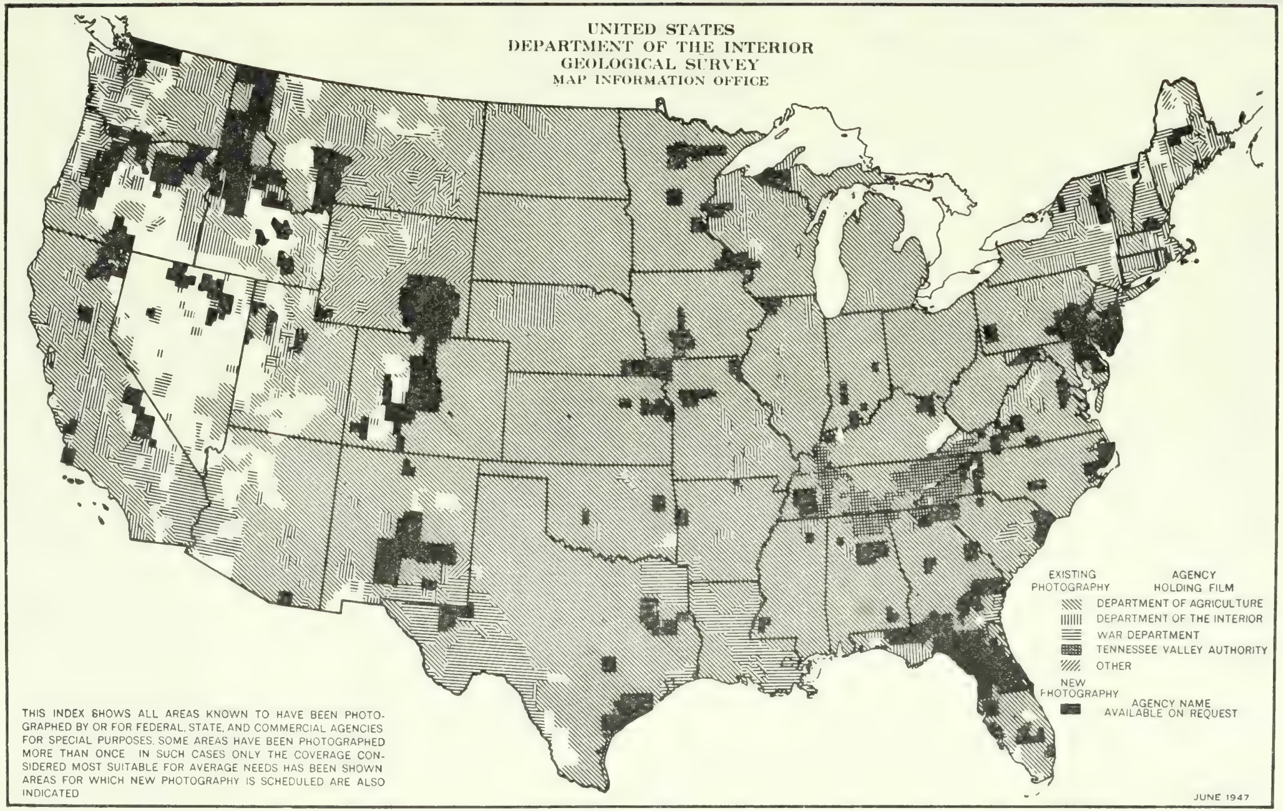
Photogrammetry

The Section of Photogrammetry is now charged with two main responsibilities—the research and development of photogrammetric instruments and equipment and the procurement of aerial photography, including the preparation of specifications, administration of contracts, and inspection of materials.

A considerable amount of captured German equipment has been evaluated, repaired, and in some cases redesigned and made available for both experimental and production use. The most notable item is an extremely accurate German aerial camera lens, which far surpasses the best lenses heretofore manufactured in this country. Arrangements have been made for domestic quantity manufacture of this lens. Another item of great interest and potential value is an experimental photogrammetric mapping instrument, still unfinished at the time of its capture. Work has been progressing on the design for completing this instrument.

Precision photogrammetic plotting instruments manufactured in Switzerland were purchased and are undergoing work tests to determine the most efficient combinations and types for our domestic mapping needs. Along with these investigations of foreign equipment, new developments in photogrammetric instruments in this country are being closely followed so that no promising equipment or ideas will be overlooked.

To meet expanded needs, contracts were awarded for approximately 80,000 square miles of aerial photography. To date about 30,000 square miles of photographic coverage has been completed, and it is anticipated that the remaining 50,000 will be available by 1948.


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MAP INFORMATION OFFICE
EXISTING PHOTOGRAPHY
AGENCY HOLDING FILM
▧ DEPARTMENT OF AGRICULTURE
▥ DEPARTMENT OF THE INTERIOR
▤ WAR DEPARTMENT
▦ TENNESSEE VALLEY AUTHORITY
▨ OTHER
NEW PHOTOGRAPHY
■ AGENCY NAME AVAILABLE ON REQUEST
JUNE 1947

THIS INDEX SHOWS ALL AREAS KNOWN TO HAVE BEEN PHOTOGRAPHED BY OR FOR FEDERAL, STATE, AND COMMERCIAL AGENCIES FOR SPECIAL PURPOSES. SOME AREAS HAVE BEEN PHOTOGRAPHED MORE THAN ONCE IN SUCH CASES ONLY THE COVERAGE CONSIDERED MOST SUITABLE FOR AVERAGE NEEDS HAS BEEN SHOWN AREAS FOR WHICH NEW PHOTOGRAPHY IS SCHEDULED ARE ALSO INDICATED

STATUS OF AERIAL PHOTOGRAPHY IN THE UNITED STATES

A complete file of aerial photographs obtained for mapping projects is maintained in this section. From the approximate total of 320,000 photographs on hand, other agencies and the public purchased reproductions for which the Geological Survey was reimbursed to the amount of $8,818.36.

Topographic Surveys

The Section of Topographic Surveys is comparatively new, having been in operation for only 3 months of the fiscal year 1947. Considerable progress has been made on its most urgent work—that of reviewing existing instructions and preparing new ones covering those phases of mapping which are separate and distinct from photogrammetry and control surveys. Preliminary instructions on advance photo interpretation, field-completion surveys, map-accuracy test surveys, and quadrangle reports have been completed and issued in advance form. As a basis for detailed discussion leading to final standard instructions, a number of technical memoranda have been prepared pertaining to map portrayal of airway facilities, bridges, buildings, railroads, roads, drainage, civil boundaries, public-land lines, contour intervals, woodland, names, and symbols. With respect to specifications pertaining to scale, contour interval, and sheet size, a comprehensive study of mapping in each State has been completed, and recommendations have been drawn up covering those technical requirements.

Preliminary work has been started on an outline for a new Topographic Manual to supersede the present topographic instructions prepared in 1928. All existing instructions are scheduled for review and, where necessary, revision or complete new instructions will be issued. This is particularly urgent because of the great technical advance achieved in mapping methods, instruments, and procedures before and during World War II.

Special Map Projects

The Special Map Project Section is concerned with the compilation of State, sectional, and regional maps at scales of 1:250,000, 1:500,000, 1:1,000,000, or smaller.

Work on the International Map of the World on a scale of 1:1,000,000 was continued by this section. Eight sheets were in course of preparation: Lake Erie (K–17), Cascade Range (L–10), Mount Shasta (K–10), Austin (H–14), Mississippi Delta (H–15), Savannah (I–17), Los Angeles (I–11), and Blue Ridge (J–17). At the end of the year seven sheets had been transmitted for or were in process of publication: Hatteras (I–18), Chicago (K–16), Lake Erie (K–17), Cascade Range (L–10), Mount Shasta (K–10), Austin (H–14), and Mississippi Delta (H–17).

Preparation of transportation maps for the Public Roads Administration was continued. Compilation, inking, lettering, and editing was in progress for the States of West Virginia, Ohio, Nevada, Alabama, Indiana, and Missouri. Nine sheets of Louisiana and five sheets of West Virginia were transmitted for reproduction; eight sheets in North Carolina, eight sheets in Virginia, and one sheet of Washington, D. C. and vicinity are all in various stages of reproduction. Of 33 sheets designed for Texas, 23 were published.

Compiling, inking, and lettering is in progress on the revision of State base maps, scale 1:500,000, for the States of Wyoming, New Jersey, Massachusetts, Rhode Island and Connecticut, Maryland and Delaware, and Illinois. The combined print of the Wyoming map is in first proof. Miscellaneous other special maps were prepared by this section during the year.

Cartographic Procedures

The Section of Cartography and Map Editing has two broad responsibilities—general administration over all cartography from the technical viewpoint, and administrative and operational executive charge of map editing.

During the year considerable progress was made toward the standardization of cartographic procedures and symbols. Work of this nature must be thoroughly coordinated with that of other Federal agencies that produce maps and charts, with full consideration of all elements of map and chart use. Joint committees that include representatives of the military establishments, Bureau of the Budget, and other agencies are collaborating with the Geological Survey on all current problems of this nature. Various technical memoranda have been issued, and many others, covering problems in the fields of map symbols, drafting, and editorial procedures are in course of preparation.

Map Editing

During the year 173 quadrangle maps were edited for publication, of which 144 were for multicolor photolithography and 29 for engraving; 524 quadrangle maps, 14 State maps, and 9 State index maps were prepared and edited for reprint editions; 270 maps and diagrams that had been prepared as illustrations for geologic reports were edited; and 290 proofs of all kinds were read. At the end of the year maps in process of reproduction included 35 for engraving and 47 for multicolor photolithography; maps being edited or awaiting editing included 14 maps for engraving and 75 for multicolor photolithography; and 484 maps remained on hand for preparation for reprinting.

Planning, Production, and Coordination

The primary functions of the Section of Plans and Estimates, the Section of Production Control, and the Section of Coordination and Liaison are closely interrelated and include the responsibility to assure that mapping funds are fully allotted to those areas in which there is the greatest need for topographic maps; the implementation of effective methods of cooperation and planning with other Government agencies to prevent duplication of effort or unjustified expenditure of public funds; the consummation of cooperative mapping agreements with States and municipalities whereby the cost of the mapping is met by joint, equal contributions from the Geological Survey and the participating agency; the establishment and operation of a method of production control, which, through use of the machine tabulating system, is designed to yield production costs, allotment accounting, accomplishment data, and a certain amount of pay-roll accounting.

In the line of planning, much has been accomplished in considering requests for mapping in order to determine priorities and to correlate the work program with budget estimates. Close liaison between planning and production control affords better administration in the allotment and expenditure of funds.

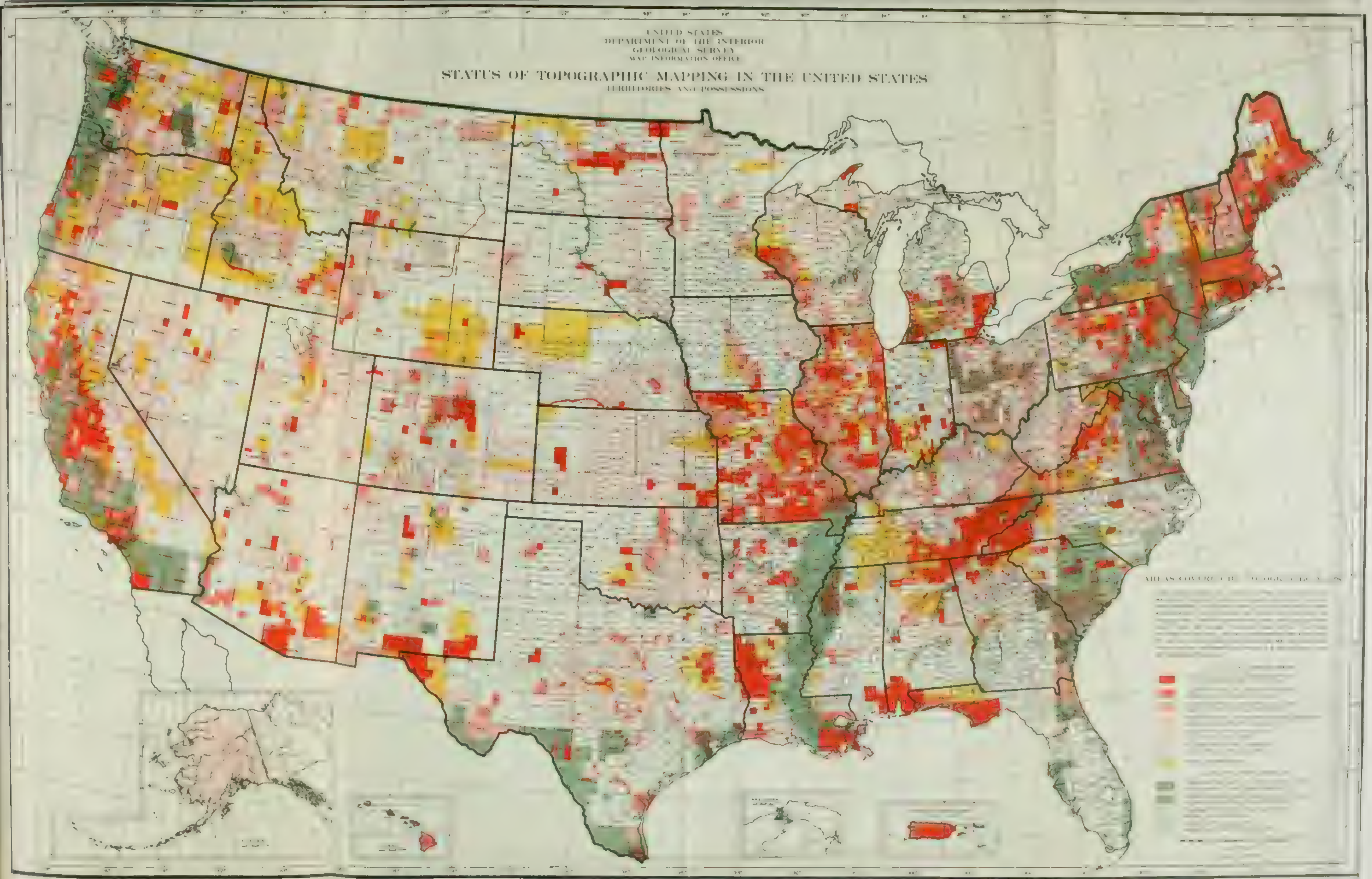
A very important aspect of coordination, that of reaching an understanding with other Government agencies regarding respective spheres of activity, resulted in signed agreements between the Geological Survey and the War Department, the Coast and Geodetic Survey, the Forest Service, and the Bureau of Reclamation. As the Bureau of Reclamation is an agency within the Department, the agreement with it also extended into the field of technical assistance on such matters as review and advice by the Geological Survey concerning specifications for proposed mapping or aerial photographic projects and preparation for inspection and testing of commercial contract mapping. The Geological Survey also undertook the execution of an extensive mapping program in the Missouri Basin area, using funds transferred by the Bureau of Reclamation.

The cooperative program with State and local agencies, which naturally was at a low ebb during World War II and the first year thereafter, has taken on fresh impetus, and numerous conferences have been held with State officials to arrange existing or imminent programs and to present to prospective cooperators the possibilities for initiating similar programs in their States or areas.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MAP INFORMATION OFFICE

STATUS OF TOPOGRAPHIC MAPPING IN THE UNITED STATES

TERRITORIES AND POSSESSIONS



Map Information Office

During the year, the Map Information Office has continued to serve the Geological Survey, other Federal and State agencies, and the public by supplying information regarding maps, aerial photographs and mosaics, and control surveys. Coincident with this service, every effort has been made to assemble such surveying and mapping data as is adaptable into publications for distribution.

An index presenting the appraisal of existing topographic mapping was completed and printed, and a revised issue which will show and evaluate mapping accomplished by other agencies is in process. Another index to mapping, which will show publication scales, is also being prepared.

A summary statement concerning the surveying and map-compilation projects of the Federal Government in 1946 was completed for publication. This summary presents the accomplishments of Federal map-compiling and map-producing agencies, as well as those mainly concerned with map research and the maintenance of comprehensive map libraries.

Work has been started on the compilation of an index which will show the distribution of all vertical and horizontal control established by the Geological Survey and other agencies.

Two issues of an index map showing the aerial photographic coverage available from Government agencies and commercial firms have been published. Nearing completion are 10 master base maps, one for each of 9 Government agencies concerned, the other for commercial aerial survey firms who regularly procure aerial photographs. These maps will show the date of photography, focal length of lens, scale, and extent of coverage pertaining to the photographic holdings of the 10 organizations. This series represents an inventory of aerial photography of the United States, including additional sets of photographs of the same area.

Also nearing completion is an index map of the United States showing the available mosaics held by the various Government agencies, together with information as to scale and date. While it is not feasible to print copies of all these compilations for distribution, provision will be made whereby some type of photographic copies of those not printed may be purchased at the cost of reproduction.

As a most necessary activity, records of new mapping, geodetic surveys, aerial photography, and mosaic projects are currently added to our cumulative indexes. Before new work is undertaken other agencies require that a check be made with the Map Information Office, to avoid the overlapping of surveying and mapping projects.

A steady increase in volume of requests by letter, telephone, telegram, and personal visits has continued throughout the year. Particularly significant was the demand for technical data for administrative and planning purposes in connection with drainage, flood control, irrigation, water supply, hydroelectric, television, and radio broadcasting, and transportation projects. Numerous requests were also received from educational institutions for mapping and surveying data and for general information regarding mapping to be included in bulletins, papers, and addresses before student bodies and the public.

During the year, exhibits of maps, aerial photographs, and related material pertaining to mapping procedures were prepared for the Pan American Institute of Cartography and History at Caracas, Venezuela, the American Mining and Metal Congress at Denver, Colo., Middlebury College at Middlebury, Vt., the American Society of Civil Engineers at St. Paul, Minn., the American Society of Photogrammetry at Washington, D. C., the Utah Centennial at Salt Lake City, Utah, and the National Research Council at Washington, D. C.

Recognition of the Geological Survey's preeminence in the field of mapping is further evidenced by the number and type of visitors during the year. In addition to those from our own country, civil and military representatives of the following foreign governments have spent considerable time studying and observing field and office methods used by the Topographic Branch in preparing maps: Canada, Mexico, Cuba, Brazil, Chile, Colombia, Peru, Venezuela, Belgium, Denmark, France, Great Britain, Greece, Netherlands, Norway, Sweden, Egypt, South Africa, China, India, Palestine, Australia, and the Philippine Islands. In practically all of these countries the development of new mapping methods was considerably curtailed during the war. Letters of appreciation received from these foreign visitors during the year indicate that the technical assistance and advice given by members of the Survey is contributing not only to the progress of mapping throughout the world, but to a mutual understanding of good will and a friendly spirit of cooperation.

Trimetrogon Mapping

The Trimetrogon Section was established at the beginning of the fiscal year 1947 to carry on the same type of work that was done during the war for the Army Air Forces by the Alaskan Branch—mapping and charting by the trimetrogon method. This method, which was developed at the beginning of World War II by the Geological Survey in cooperation with the air forces, has been so satisfactory that several million square miles of planimetric and topographic charting has been accomplished in areas that previously were either inadequately mapped or entirely uncharted. The work is done on a reimbursable basis for the Army Air Forces' Aeronautical Chart Service.

The over-all program, of which this work forms a part, is one of maintenance of adequate world coverage of aeronautical charts, in the interest of national defense. It calls for periodic review of all existing aeronautical charts with a view to progressive revision or recompilation of those charts which current world affairs indicate as pertinent.

While chart priorities are established by the Army Air Forces as are the detailed specifications and other technical requirements, the Geological Survey's Trimetrogon Section conducts the editorial review and evaluation of assigned charts, makes observations and recommendations pertinent to their validity, and, upon request, prepares by photogrammetric means revised or recompiled base charts preliminary to photolithographic reproduction. For each chart reviewed a complete and detailed compilation history is prepared showing the original source of information used and its evaluation.

In addition, the section maintains the only existing world-wide reference library of trimetrogon photographs. This contains several million oblique and vertical photographic prints, from which is obtained the basic information for its own charting work as well as for reference by other organizations whose interests may be in the fields of geology, forestry, water resources, construction, national defense, or other engineering developments.

During the year this section completed 628,000 square miles of entirely new compilation, all of which was subjected to rigid inspection in the photo-topographic unit, where appropriate contouring was added; it also accomplished approximately 800,000 square miles of chart revision, making a total of more than 1,400,000 square miles. This charting covered areas in practically every part of the world and may be summarized as follows:

Preliminary charts at scales 1:500,000 and 1:250,000 (foreign)	104
World aeronautical charts at scale 1:1,000,000 (foreign)	35
Pilotage charts at scale 1:500,000 (foreign)	16
Approach and landing charts at scale 1:250,000 (foreign)	3
Special charts (domestic)	2

In addition, there are currently under way 239 similar charts in various stages of completion.

Coincident with the discharge of its major responsibility for mapping and charting, the Trimetrogon Section has also engaged in several special projects for other branches of the Geological Survey and for the Army. These include a start on the microfilming of approximately 48,000 field note and computation record books of horizontal and vertical control data, about 5 percent completed; further study of the trimetrogon system to determine the feasibility of this method for application to the small-scale mapping currently being considered for unmapped expanses in the Western United States; cooperative endeavor on the initial planning of small-scale map and photographic requirements for that western area; and consultation and assistance in planning pertaining to the mapping aspects of "Operation Crossroads" at Bikini. Worthy of special mention is the preliminary planning, which was done, and the expected assignment of preparation of the map of Antarctica, using aerial photographs taken by the United States Naval Expedition while on "Operation High Jump." This latter project is jointly sponsored by the Army and Navy.

Throughout the year assigned research was for the military and naval forces with a view to establishing limits of accuracy of present operations and evaluating the effectiveness of certain instrumental and procedural modifications.

Mapping Accomplishments

Topographic mapping was carried on during the year in 40 States. Cooperative projects were conducted with 20 States and with the Tennessee Valley Authority.

The mapping of 46 15-minute quadrangles and 299 7½-minute quadrangles was completed, and mapping was in progress on 75 15-minute quadranges and 396 7½-minute quadrangles at the end of the year. In addition, work on 510 quadrangles was progressing in some one of the steps prior to actual mapping.

The resurvey of the entire area of the State of Massachusetts on the scale 1:31,680 was completed, replacing previous mapping on the scale 1:62,500. The revision of the maps of the San Joaquin Valley in California was continued, 55 quadrangles being completed during the current fiscal year.

Mapping of the Bremerton area, in the vicinity of Port Orchard, in the State of Washington was begun. A shaded relief map of the State of Utah was completed.

For the Corps of Engineers, Army, mapping of the following areas was completed: Camp Atterbury, Ind.; Camp Shelby, Miss.; and the Meramec River project, Missouri. Mapping was in progress at Camp Croft, S. C.; Camp Beale, Calif.; Camp Ellis, Ill.; Camp Ellis maneuver area, Illinois-Missouri; Fort Custer, Mich.; Camp Bowie, Tex.; Camp Maxey, Tex.-Okla.; and Camp McCoy, Wis. Basic control was accomplished at Camp Irwin and Fort Ord, Calif.; Fort Benning, Ala.-Ga.; Fort Riley, Kans.; Camp Campbell, Ky.-Tenn.; the Joanna reservoir site on Salt River, Mo.; Fort Bragg, N. C.; and the Big Bend project, east of El Paso, Tex. Field control and stereoscopic mapping were completed for the Missouri River project, extending from Niobrara, Nebr., through South Dakota and to Bismarck, N. Dak.

Topographic mapping by the Geological Survey in the United States, Alaska, Hawaii, and Puerto Rico, to June 30, 1947

State	Area mapped during fiscal year 1947 for publication on standard scales, contour intervals from 5 to 50 feet (square miles)					Total area mapped to June 30, 1947 (square miles)	Percentage of total area of State mapped to June 30, 1947	Control, fiscal year 1947		
	Field scale		New survey	Resurvey	Revision			Spirit levels (miles)	Transit traverse (miles)	Triangulation stations established
	1 to 24,000 or larger	1 to 48,000								
Alabama	816	--------	324	492	--------	26,672	51.7	527	516	--------
Arizona	--------	251	251	--------	--------	35,187	30.9	219	--------	34
Arkansas	--------	93	93	--------	--------	24,760	46.6	--------	--------	--------
California	4,174	307	259	990	3,232	133,076	83.9	1,787	--------	187
Colorado	--------	--------	--------	--------	--------	58,363	56.0	17	--------	39
Connecticut	--------	--------	--------	--------	--------	5,009	100.0	--------	--------	--------
Delaware	--------	--------	--------	--------	--------	2,057	100.0	--------	--------	--------
District of Columbia	--------	--------	--------	--------	--------	69	100.0	--------	--------	--------
Florida	--------	--------	--------	--------	--------	11,949	20.4	684	478	--------
Georgia	--------	241	--------	241	--------	25,202	42.8	625	329	--------
Idaho	632	82	580	134	--------	38,544	46.1	376	--------	55
Illinois	322	2,471	2,399	322	72	50,163	88.9	324	390	--------
Indiana	1,141	--------	1,141	--------	--------	9,890	27.3	1,036	607	--------
Iowa	--------	--------	--------	--------	--------	14,233	25.3	--------	--------	--------
Kansas	--------	127	--------	127	--------	65,852	80.0	282	287	--------
Kentucky	4	--------	--------	4	--------	27,805	68.8	391	142	--------
Louisiana	203	321	524	--------	--------	19,425	40.0	185	132	--------
Maine	--------	241	223	18	--------	26,200	78.9	--------	--------	--------
Maryland	45	--------	--------	45	--------	10,577	100.0	199	--------	--------
Massachusetts	550	--------	--------	103	447	8,257	100.0	--------	--------	--------
Michigan	118	320	368	70	--------	18,170	31.2	384	115	9
Minnesota	4	--------	4	--------	--------	9,576	11.4	--------	--------	--------
Mississippi	1,022	--------	1,022	--------	--------	10,032	21.0	551	651	--------
Missouri	[1] 73	1,037	550	523	37	64,498	92.6	89	6	--------
Montana	307	88	301	94	--------	40,089	27.2	406	296	--------
Nebraska	757	53	810	--------	--------	29,218	37.8	2,950	2,163	106
Nevada	--------	11	--------	11	--------	44,165	40.0	141	54	45
New Hampshire	--------	145	--------	145	--------	9,304	100.0	--------	--------	--------
New Jersey	--------	--------	--------	--------	--------	7,836	100.0	--------	--------	--------
New Mexico	249	--------	--------	249	--------	36,676	30.1	397	--------	--------
New York	170	--------	--------	170	--------	49,576	100.0	33	--------	--------
North Carolina	31	68	99	--------	--------	19,764	37.5	57	44	--------
North Dakota	541	434	975	--------	--------	19,122	27.1	176	401	--------
Ohio	--------	--------	--------	--------	--------	41,222	100.0	--------	--------	--------
Oklahoma	94	--------	--------	94	--------	41,901	59.9	61	64	--------
Oregon	--------	652	652	--------	--------	37,090	38.2	85	--------	--------
Pennsylvania	1,991	--------	713	1,278	--------	44,674	98.5	104	--------	--------
Rhode Island	--------	--------	--------	--------	--------	1,214	100.0	--------	--------	--------
South Carolina	463	103	325	241	--------	16,726	53.8	--------	--------	--------
South Dakota	--------	--------	--------	--------	--------	20,750	26.9	875	752	36
Tennessee	798	--------	540	258	--------	24,538	58.1	447	345	--------
Texas	1,137	40	538	639	--------	93,933	35.1	1,528	1,475	13
Utah	57	--------	--------	57	--------	20,272	23.9	--------	11	25
Vermont	160	--------	--------	160	--------	9,365	97.5	--------	--------	--------
Virginia	103	272	--------	375	--------	38,097	93.3	141	121	--------
Washington	--------	543	139	404	--------	44,700	65.6	191	--------	36
West Virginia	--------	215	--------	--------	215	24,181	100.0	--------	--------	--------
Wisconsin	--------	[2] 676	676	--------	--------	21,024	37.4	472	851	--------
Wyoming	127	3	127	3	--------	36,296	37.1	287	--------	67
Total	16,089	8,794	13,633	7,247	4,003	1,467,299	48.5	16,027	10,230	652
Alaska	--------	--------	--------	--------	--------	[3] 268,401	47.0	--------	--------	--------
Hawaii	--------	--------	--------	--------	--------	6,435	100.0	--------	--------	--------
Puerto Rico	--------	--------	--------	--------	--------	3,370	98.8	--------	--------	--------

[1] Includes 49 square miles mapped on scale of 1:12,000.

[2] Planimetric maps covering 664 square miles in Wisconsin, not included in total surveys, were compiled from aerial photographs with field examination.

[3] Includes 5,000 square miles mapped on scale of 1:62,500 or larger; balance of area mapped by reconnaissance methods and published on scale of 1:250,000. In addition to the total area indicated, 48,000 square miles of planimetric mapping was accomplished.

At the request of the National Park Service, the mapping of the Jackson Hole National Monument in Wyoming was begun and that of the Olympic National Park in the State of Washington was continued.

At the request of the Bureau of Reclamation the Topographic Branch is devoting a large part of its efforts to preparing topographic maps of the Missouri River Basin. Of this important area of over 500,000 square miles, containing so much of the resources vital to our Nation, less than 10 percent had previously been covered by topographic maps suitable for water development or other engineering studies. The Bureau of Reclamation is engaged in numerous projects throughout the basin for irrigation, flood control, power development, water supply, and navigation. The topographic maps produced will serve for the planning of these projects and as bases for studies made by other Government agencies preliminary to the construction work. Large areas have been mapped in Montana, Nebraska, North Dakota, and Wyoming. The Powder River strip-mapping has been completed. Other work was focused on the Missouri-Souris area and the Niobrara River subbasin. In addition, an administrative planning map of the Missouri Basin was compiled and reproduced for use as an over-all reference map in outlining both future plans and progress or status of current programs. Also completed for the Bureau of Reclamation was the triangulation of the San Juan-Chama Transmountain Diversion project, Colorado.

Mapping in the Columbia River Basin for flood control, power, and irrigation continued, the major surveys completed during the fiscal year being in the Snake River Basin, Idaho.

The mapping of Alaska was assigned to the Rocky Mountain Division at the beginning of the year. Thereafter, field and office work progressed on compilation of topographic maps on the scales of 1:62,500 and 1:250,000, and in addition, maps of 11 areas were prepared at the special request of other Government agencies. In the Naval Petroleum Reserve, where 48,000 square miles of planimetric mapping were completed, a new aerial photographic project of 12,000 square-mile extent is in progress. By the end of the year about 10 percent of the area had been photographed.

In the 1:62,500 series, three quadrangles, the Umiat, Fairbanks, and Tuxekan, were contoured in the field and final drafting was completed in the offices; a fourth sheet, Juneau and vicinity, was revised by field work. In the 1:250,000 series, eight quadrangles totaling approximately 56,000 square miles were advanced through the manuscript stage. Contours will be shown on all but 7,630 square miles of these areas. Of the 11 areas mapped for other civilian agencies, a total of 19,907 square miles was done for the Geologic Branch and

1,450 square miles for the Bureau of Land Management. Contours will be shown on all these sheets.

Shaded relief has been completed for the sheet Valdez and vicinity, a special map now in progress.

The existing aerial photographic coverage of Alaska was greatly augmented by the receipt from the Army Air Forces of 57,000 square miles of new trimetrogon charting photography. There is, however, a definite need for additional photographic mapping done in accordance with standard specifications. A program has been promulgated recently whereby the War Department will furnish photographs covering central Alaska and the Aleutians, and the Navy Department will cover southeastern Alaska.

In the mapping of Puerto Rico, which had been essentially completed during the previous year, preparation from the original multiplex manuscripts of a special edition, scale 1 : 10,000, was started. Of an ultimate total of 155 sheets, in this particular project 60 of the special sheets were printed by the end of fiscal year 1947. The regular published sheets of this mapping area are on the scale 1: 30,000. The large-scale sheets were produced upon request of the Government of Puerto Rico and are reported to be a great aid to engineering and other studies being made on the island.

WATER RESOURCES BRANCH

Water is the Nation's most important natural resource. Although there is hardly a place in our country that does not have some supply of water, many supplies are inadequate. It is the work of the Water Resources Branch to find and evaluate our water supplies and tell the people about them. The quantity of water flowing in streams or through the ground varies so much from time to time and from place to place that careful observations must be made over a period of many years before the amount of water available from any source of supply can be told. Even though the supply may be ample in amount it may still be inadequate because the quality is not good. The kind and amount of materials dissolved or the amount of sediment carried may be so large that the water is unsuitable for the proposed use. Accurate knowledge about a water supply—its variation in quantity from day to day and year to year and its chemical quality or sediment load—is necessary for the planning of projects involving irrigation, inland navigation, power generation (both steam and hydraulic), municipal supply, flood control, industrial processes, and the maintenance of fish and wildlife.

The spreading of people and industry throughout the country has been increasing rapidly in recent years. It may reach staggering proportions if a real effort is made to minimize through dispersion the effect of possible atomic bombing. Successful dispersion is possible only if adequate water supplies can be found. Water investigations are being made in all sections of the country, but these investigations take time. They are made by a specially trained scientific organization whose past appropriations have been barely sufficient to meet existing needs.

Projects dependent on water supply that are already in operation must have current information about that water supply in order to operate satisfactorily. As more water supplies are being utilized to capacity, the Geological Survey is called upon to furnish more up-to-date water information. Part of this need is met by the Water Resources Review, a monthly press release giving current information about water supplies in the United States and Canada. The monthly release is supplemented by a semiannual summary of conditions, and the October-to-March issue contains also a summary of snow measurements and predictions of spring run-off. A minor part of the water-resources information collected for operational needs is paid for by those concerned, such as licensees of the Federal Power Commission. Generally, however, the collection of current information is an obligation of the Federal Government, either with or without the cooperation of States and municipalities. This information must be collected as long as the water supplies are being used.

Federal Government's Interest in Water Resources

The Federal Government is a large user of water-resources information. In planning regional developments the importance of water has been recognized in defining regions in terms of drainage basins. In the development of the Missouri River Basin now under way a vast amount of water-resources information has been required in addition to that which had already been collected up to the limit of available appropriations. Whether other regions are developed as a whole or progressively, unit by unit, many projects will be so large that they must be undertaken by the Federal Government. Most regional projects are based on use of water. More and better information on water resources will be needed to plan projects that will be economically sound.

Water-resources information is used by the Federal Government in many other ways that are necessary though less spectacular than the regional development projects. At the other extreme, for example, is the development of stock tanks and wells on the public domain. The amount of livestock that can forage on a given area may be restricted as much by the water supply as by forage cover. On some parts of the public domain the forage is unused because of its distance from water; other parts, near water, are overgrazed. By finding and developing new sources of water supply, grazing can be increased by spreading it more uniformly; this means producing more livestock and thus more food for the Nation. The actual quantity of water needed for stock is small, but in few other ways does use of water pay such large dividends.

The Federal Power Commission requires licensees operating hydroelectric projects to measure the flow of streams used to generate power. At the request of the Federal Power Commission the Geological Survey during 1947 supervised stream gaging on about 125 licensed projects.

The magnitude of the interest of the Federal Government in water-resources information is shown by the nearly $2,000,000 transferred during 1947 by other agencies to provide for investigations to be made by the Geological Survey that could not be financed within its own appropriation. Those agencies are the Bureau of Reclamation, Office of Land Utilization, Office of Indian Affairs, Fish and Wildlife Service, Southwestern Power Administration, Bonneville Power Administration, and National Park Service, Department of the Interior; Corps of Engineers, War Department; Navy Department; State Department; Weather Bureau, Department of Commerce; Department of Justice; Tennessee Valley Authority; Veterans' Administration; Federal Power Commission; Federal Works Agency; and Public Health Service, Federal Security Agency.

Cooperation With States and Municipalities

The welfare of the Nation is dependent on agriculture and industry, and the welfare of agriculture and industry depends on adequate water supplies. The information on water supplies collected by the Geological Survey thus benefits all and is available to all. The usefulness of this information to the people living within the area in which it is obtained is so great they have for many years supplemented Federal appropriations for this work with State and local funds. For this reason the major part of the water investigations of the Geological Survey are made in cooperation with the States and local communities. Most of these investigations must be started well in advance of a project because many years of records are necessary for the economic planning of a specific project. An adequate record once collected and compiled may be of value for many and diverse uses. The operation of hydraulic and industrial plants, on the other hand, requires current information about the fluctuations in water supplies.

As the limit of a supply is approached or reached, the demand for reliable up-to-date information becomes more insistent. That the importance of this work is recognized by State and local communities is shown in the way funds offered by those agencies for cooperation with the Geological Survey have consistently exceeded the funds regularly appropriated to the Geological Survey for that purpose. The regular appropriation for cooperative work in 1947 was $1,620,000; this was increased by $90,000 in the second deficiency act. The amounts offered for cooperation in fiscal year 1947 in each State are summarized below:

State:	Total offered	State:	Total offered
Alabama	$14, 937	New Hampshire	$10, 258
Arizona	73, 345	New Jersey	27, 359
Arkansas	21, 804	New Mexico	58, 259
California	105, 048	New York	123, 120
Colorado	45, 881	North Carolina	35, 870
Connecticut	12, 250	North Dakota	31, 619
Delaware	7, 152	Ohio	91, 534
Florida	79, 497	Oklahoma	31, 855
Georgia	25, 858	Oregon	34, 667
Idaho	39, 466	Pennsylvania	69, 378
Illinois	40, 632	Rhode Island	4, 707
Indiana	50, 232	South Carolina	15, 961
Iowa	33, 791	South Dakota	6, 137
Kansas	32, 139	Tennessee	30, 532
Kentucky	33, 639	Texas	102, 066
Louisiana	30, 950	Utah	52, 690
Maine	8, 576	Vermont	6, 260
Maryland	32, 201	Virginia	47, 806
Massachusetts	33, 300	Washington	102, 321
Michigan	67, 534	West Virginia	14, 263
Minnesota	21, 726	Wisconsin	28, 782
Mississippi	17, 494	Wyoming	31, 875
Missouri	18, 492	Hawaii	55, 523
Montana	16, 644	Puerto Rico	1, 498
Nebraska	31, 587		
Nevada	27, 966	Total	1, 936, 481

In addition to the above amounts, more than $30,000 was available to meet cooperative contract obligations carried over from fiscal year 1946.

Total Funds Available

Funds aggregating more than $6,350,000 were available for water investigations in the fiscal year 1947. Of that amount about 41 percent was appropriated by Congress, and 31 percent was contributed by States and municipalities, and about 28 percent was provided by other Federal agencies.

Field Offices

Water investigations can best be made from local field offices. The Survey's investigations of water have been made from the field for many years, and in 1947 the work was conducted from more than 100 such offices, with one or more in nearly every State and in the Territory of Hawaii. This decentralization results in a high degree of efficiency and economy of work and in better service to the public. Close contacts are maintained with local Federal, State, and municipal officials, and the interests of cooperating agencies are served. The Survey's field offices are local sources of information as to available water resources, fluctuating stage and discharge of surface streams, and fluctuations in the ground-water table.

Surface Water

Although the water resources investigations are separated for administrative purposes and for reporting into three classes—surface water, ground water, and quality of water—each class is so related to the others that only by giving proper attention to all three can a complete and adequate water-resource investigation be made.

Recognition of the vital importance of surface water supplies is shown by the steadily increasing demands from many sources for more information. This has been accompanied by increases in the amount of funds expended by States and municipalities for water-resource investigations in cooperation with the Geological Survey. At the end of the fiscal year 1947 there were in operation for measuring the stage and flow of lakes and surface streams 5,812 gaging stations distributed throughout the States and in the Territories of Alaska and Hawaii. These gaging stations were operated through more than 60 field offices in cooperation with 171 State and political subdivisions and with several Federal agencies. The stream-gaging program in Alaska was begun in 1947 with the establishment of seven gaging stations; plans have been made for the continuation and gradual expansion during the fiscal year 1948 of this modest initial program. A two-way radio station, installed at the gaging station on Colorado River at Lees Ferry, Ariz., will make information on the flow of the river available promptly for use in administering the Colorado River Compact and for operating Federal projects, such as Hoover Dam. Steps were taken to expand laboratory and shop facilities for the development and improvement of equipment for the measurement of the discharge of streams. The discharge of rivers affected by backwater was studied in the laboratory. The development and construction of a special type snowmobile for winter observations in remote mountain areas is being carried on in cooperation with the Soil Conservation Service, Department of Agriculture. A program was started during 1947 in close cooperation with the Public Roads Administration and various State highway departments to work out better procedures and promote better utilization of stream-flow records in the solution of hydraulic and hydrologic problems connected with highway structures.

Ground Water

Ground-water investigations are made to find out how much water is available below the surface of the ground and the best means of recovering it for beneficial use. The problem is large and complex, for although there is ground water almost everywhere, it occurs under widely different conditions, and the quantity and quality differ widely from place to place. More than a million dollars is being spent every day to obtain ground water. The amount of ground water now used for various purposes has been estimated as follows:

Type of use:	*Quantity used daily (gallons)*
Irrigation	10,000,000,000
Industrial	5,000,000,000
Municipal	3,000,000,000
Rural	2,000,000,000

The quantity used today is nearly twice that used 10 years ago. Increases have been greatest in irrigation and industrial uses, but there have also been large increases in municipal and rural uses. Many of our ground-water reservoirs have been depleted by this increased use, much of which resulted from withdrawals for war needs in places where the reservoirs were already being drawn upon to the limit of their safe yield. In these areas there have been failures and shortages of water. A basic need is the systematic collection and interpretation of essential facts concerning our ground-water reservoirs.

During the fiscal year 1947 ground-water investigations were being made on about 350 projects scattered through nearly every State, Hawaii, and Puerto Rico. These activities were conducted through 36 district offices and in financial cooperation with 75 State, county, and municipal agencies and with several Federal agencies.

Nearly 200 formal reports of various kinds were prepared and several thousand requests for information on ground-water conditions in all parts of the country were answered.

Quality of Water

Not all water is fit to drink; neither is all of it suited for industrial use, irrigation, or a multitude of other purposes for which there is no substitute. Information on the dissolved chemicals found in any water supply or the sediment carried by it is often as important as knowledge of the quantity; sometimes more so.

During the past fiscal year, 11,087 samples of water were analyzed for chemical quality in the central laboratory in Washington, D. C., and in the nine field laboratories strategically located over the country. The information obtained from these analyses will enable present and potential users of water in the areas sampled to evaluate the suitability of the available water for their purposes. These analyses, added to those made in previous years, serve as a permanent record of the variations in chemical condition of the streams, which rapidly increases in value as each year's record is added. Cooperative investigations of the chemical quality of surface waters were in progress in Pennsylvania, Virginia, Georgia, North Carolina, South Carolina, Florida, Arkansas, Texas, Oklahoma, Ohio, Iowa, and New Mexico. Samples were also analyzed for cooperative studies of ground waters in those and other States. Two field laboratories were established during the year, one at Salt Lake City, Utah, and the other at Philadelphia, Pa. The laboratory at Salt Lake City is a regional laboratory designed to serve both Federal and State interests in a large area in the West. The Philadelphia laboratory was set up on a limited scale to handle a portion of the State cooperative program in Pennsylvania.

The large amount of sediment carried in many of the Nation's rivers does much to destroy their usefulness. Reservoirs on these rivers are rapidly filled with sediment, leaving little room for storage of water. Many small reservoirs have been completely filled in periods of from 10 to 20 years, and even the large reservoirs, such as Lake Mead, Elephant Butte, and Coolidge, have serious sediment problems.

The economic loss to farm lands resulting from uncontrolled erosion is very great. In order to determine the rate at which lands are being eroded and the rate at which reservoirs are being filled, the sediment burden of the streams must be accurately measured with reference both to the total discharge of sediment and to the distribution of sediment particles of different sizes. Progress has been made in this direction during 1947. The Geological Survey is actively engaged in an increasing but as yet limited program for measuring sediment in streams. In 1947 the Geological Survey operated laboratories for analyzing sediment at Albuquerque, N. Mex.; Lincoln, Nebr.; Worland, Wyo.; Norton, Kans.; Dickinson, N. Dak.; and Philadelphia, Pa.

Missouri River Basin

The coordinated projects of the Bureau of Reclamation and the Corps of Engineers, War Department, for the development of the Missouri River Basin have led to unusual expansion of water investigations in that basin. The investigational programs, conducted generally in cooperation with States and municipalities, have been supplemented during 1947 by the installation of 55 gaging stations; by expansions of ground-water studies to cover areas in 24 localities with problems related to ground water or to changes in groundwater conditions that may result from reservoir construction or irrigation; by 30,780 measurements of the sediment content of surface waters at 44 regular stations and 7 stations for miscellaneous measurements; by 419 analyses of the chemical quality of the waters at 13 regular stations and at 63 stations for miscellaneous records; and by hydrologic and utilization studies related to the proposed plans of development. The information obtained through these investigations is furnished to the action agencies currently or periodically as may be desired.

Interstate Compacts

Interstate compacts for division between States of waters of interstate streams, which require the Geological Survey to establish and operate gaging stations, are now in effect on Colorado River (Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada, California); Belle Fourche River (Wyoming, South Dakota); Republican River (Nebraska, Kansas); Rio Grande (Colorado, New Mexico, Texas); and Costilla Creek (Colorado, New Mexico). Similar compacts are in process of negotiation for Arkansas River (Colorado, Kansas) and Bear River (Idaho, Utah).

International Treaties

International problems related to water are increasing. The Geological Survey, using funds transferred by the State Department, makes the water-resources investigations along the Canadian boundary that are required by orders issued by the International Joint Commission, United States and Canada, under the treaty of January 11, 1909. In addition to these continuing investigations needed for division and control of waters along the international boundary, several special investigations were made in 1947 in connection with references before the Commission, particularly those relating to Columbia River Basin and Sage Creek, Mont. The Geological Survey, through agreement with the State Department, has continuing obligations for obtaining water-resources information along the Mexican boundary as required by the Mexican Water Treaty of 1944. The planned development of the Missouri River Basin also presents international water problems that have not yet been settled.

Reports on Investigations

The results of the varied studies and computations made by the Water Resources Branch are made available for public inspection as soon as practicable by placing manuscript copies of observations, measurements, and analyses in the open files of the district offices concerned as soon as they have been approved. The availability of this information is frequently announced through a press release. Streamflow and ground-water conditions in the United States and Canada are summarized monthly and semi-annually in the Water Resources Review.

The published work of the Water Resources Branch during the fiscal year 1947 consisted of 27 new water-supply papers and 1 reprint, a large number of shorter reports in the technical press, and 93 reports transmitted to cooperating State agencies for publication by them. In addition a number of miscellaneous processed reports were issued.

CONSERVATION BRANCH

June 30, 1947, marked the end of the Geological Survey's twenty-second year of stewardship over the water-power and mineral resources of public and semipublic lands under lease, license, or permit. The activities required of such a stewardship include field engineering investigations, preparation of maps and reports dealing with water power, fuels and minerals, and on-site supervision of mining and drilling methods essential to the safe production and economical utilization of such resources. The task has been performed with full realization of the responsibilities involved in the proper classification and subsequent development of these natural resources.

The magnitude of this operation has incerased at such a rate that it has practically doubled during the past 6 years. During the calendar year 1946 the total value of all minerals supervised was $178,589,000 and the United States Treasury, the Reclamation Fund, the Indian beneficiaries, and the various States were enriched by more than $15,000,000 in production royalties.

Mineral Classification

Although hampered by an abnormal turn-over of personnel, the Mineral Classification Division maintained all phases of its technical services in the administration of public and semipublic lands at an accelerated pace during 1947. In all, 14,276 public-land cases were acted on, a 25-percent increase over 1946, but in view of the increase of 53 percent in such cases received, a large carry-over of pending cases into 1948 was unavoidable. Initial or revised definitions of the known geologic structure of 13 producing oil or gas fields were prepared and promulgated, and geologic appraisal was made of 95 unit-plan or participating-area submissions. About 75 special reports were prepared for departmental agencies and others concerned on new discoveries of oil or gas on or adjacent to Federal lands; on applications for the royalty benefits accorded by the act approved December 24, 1942 (56 Stat. 1080), for the discovery of new oil or gas fields or deposits during the war emergency; and on applications for the determination of leasehold relations to the limits of producing oil or gas deposits as known on August 8, 1946, pursuant to sections 12 and 17 (a) of the act approved on that date (60 Stat. 950). For agencies concerned with the disposal of acquired Federal lands, the Division prepared determinations of the potentialities for fissionable materials of no less than 2,326 land parcels in practically every State, Territory, and possession of the United States, pursuant to Executive Order 9701 of March 4, 1946, and Departmental Order 2188 of April 19, 1946.

A new field headquarters was established during the year in New Mexico. Division geologists working in Colorado, Wyoming, Montana, Utah, California, and New Mexico made numerous "spot" investigations requisite to the administration of public-land and mineral-leasing laws, which resulted in reports and maps for official use. New or revised maps were published showing the structural geology of the Montana plains; the areal and structural geology of the Cut Bank-West Kevin border districts, Montana, supplemented by detailed maps of townships 35 and 36 north, range 3 west, and township 35 north, range 4 west, principal meridian, Montana; and the Mush Creek area, Weston County, Wyo., in which oil was discovered during the year.

Upon request of the Department of Justice, division personne undertook investigations of the mineral resources of an extensive are in western Colorado involved in the impending action of *Confederate Bands of Ute Indians* v. *United States*, No. 45585 in the United State Court of Claims.

Water and Power Classification

The field work of the Water and Power Division in 1947 was chiefl obtaining basic information concerning the water-power resources an storage possibilities of Federal lands, on which projects were pro posed for early development. Work in the Missouri River Valley was continued to meet the needs of the Bureau of Reclamation and the Corps of Engineers, United States Army, for maps to use in planning future projects in that valley.

Topographic surveys were made of five dam sites, three reservoir sites, and 390 linear miles of stream valley, of which 325 miles are in the Missouri River Basin. In cooperation with the Water Resources Branch, supervision of construction and operation was given to 163 power projects under license from the Federal Power Commission, to 239 such projects under permit or grant from the Department of the Interior, and to 168 in cooperation with the Office of Indian Affairs.

Classification of lands resulted in the addition of 8,494 acres to power-site reserves and the elimination of 74,347 acres, decreasing the outstanding reserves in 22 States and Alaska to a net total of 6,794,609 acres. Maps prepared for publication covered 560 miles of river channel and 21 dam sites. Final action involving hydraulic determination was taken on 488 cases received from departmental sources and the Federal Power Commission, and on 3,159 cases that also involved mineral classification. Investigations and studies were in progress involving the power and storage possibilities of 35 rivers. Reservoir-site reserves in nine States remain unchanged at 137,172 acres.

Mine Supervision

The Mining Division continued its work of administration of the mining operating and safety regulations under the respective mineral leasing acts, and pursuant thereto supervises operations for the exploration, development, and mining of mineral projects on Federal lands in the United States and Alaska, and of all minerals, except oil and gas, on segregated, restricted, allotted, and tribal Indian lands, and on acquired lands transferred from the Department of Agriculture to the Department of the Interior under section 402 of the President's Reorganization Plan No. 3 of 1946.

Production from these lands during the fiscal year amounted to 19,055,410 tons having a value of $73,743,600. Accrued royalties amounted to $2,439,300. Total income, including royalties, rentals, and bonuses, amounted to $2,627,270.

As part of its duties, the Division provides technical service and assistance to the Office of the Secretary of the Interior, the Bureau of Indian Affairs, and the Bureau of Land Management in the administration of mineral leases, permits, and licenses, and on related matters. It also serves as consultant to the Department of Agriculture, the Federal Public Housing Authority, Bureau of Indian Affairs, and other Federal agencies on the appraisal of mineral land, and supervises production from public lands by the Metals Reserve Company and the War Assets Administration.

As of June 30, 1947, there were under supervision 880 properties—553 on the public domain, 234 on Indian lands, 93 on acquired lands—under lease, permit, and license. These included 4 secretarial authorizations, involving lands in 13 Eastern States, 16 Western States, and Alaska.

The Mining Division cooperated with the Departments of War, Justice, and Agriculture, the Reconstruction Finance Corporation, and the War Assets Administration on mineral leasing and disposal of lands used by governmental agencies during the war emergency and provided factual data on public-domain properties for use in the consideration of loan applications. It also cooperated with the Bureau of Public Roads in determining the relative merits of applications for access roads to mineral properties.

The State of Utah led other States in the output of coal from the public domain; Wyoming was second; Montana, third; and Colorado, fourth. The output of coal from Indian land in Oklahoma increased 43 percent, or 176,300 tons, over the previous year. Coal from public and Indian lands is of great importance to iron and steel production in Western States.

The production of potassium reached a new high during the year in response to continued demand for fertilizer materials for production of food at home and abroad. More than 97 percent of the national output of potash salts containing more than 900,000 tons K_2O was produced by Government lessees, three in New Mexico and one in California. A number of prospecting permits for potassium were granted during the past 2 years for land in New Mexico and Utah, and prospecting on one of the permits in New Mexico was begun this year. Prospect drilling in advance of mine development in New Mexico during the year increased the known reserves. Modification of the regulations on March 17, 1947, permitting the holding of 15,360 acres under lease and 25,600 acres under permit, provides additional incentive for prospecting by lessees and others.

The output of phosphate from public and Indian lands increased 320,000 tons, or 300 percent, over the previous year. Departmental Order 1294, of July 2, 1938, limiting the issuance of phosphate leases to particularly meritorious cases, was revoked December 31, 1946, and legislative changes are being considered to encourage development and production of western phosphates, because of the great need for fertilizer materials.

The chief source of sodium products is the brine of Searles Lake, in California. Refined salts from that source include potassium, borax, soda ash, salt cake, bromine, burkite, and sodium-lithium phosphates. The brines are also a potential source of tungsten. New developments include the sinking of a 1,500-foot shaft in the Green River district, in southwestern Wyoming, by the Westvaco Chlorine Products Corp., to mine a bedded deposit of trona (sodium carbonate-bicarbonate). It is anticipated that the shaft will be completed in the fall of 1947. Prospecting for sodium sulfate south of Carlsbad and west of the Pecos River in New Mexico is being intensively carried on by the Ozark Mahoning Mining Co. Prospecting for sodium continued in North Dakota, Oregon, Washington, Nevada, and California.

Lead and zinc concentrates produced from Quapaw Indian lands in Oklahoma amounted to 62,000 tons, or about 7 percent of the national output, considerably less than before the war. The decrease is attributed to the continuing depletion of high- and medium-grade ore. The study of the ore reserves in the Quapaw Indian land, begun in 1944 and continued during 1947, contributed appreciably to the mining of low-grade ore and provided information needed for further prospecting in that area by operators and lessees.

Acquired land in southern Illinois is also an important source of zinc and is potentially valuable for lead. Both are associated with fluorspar, the principal output of the deposits now being worked in that area.

Barite deposits on acquired land in Arkansas and Missouri are being prospected. There is great current demand for barites for heavy mud for use in deep-well drilling for oil.

Oil and Gas Supervision

The Oil and Gas Leasing Division supervises operations for the discovery and production of petroleum, natural gas, gasoline, and butane occurring in public lands of the United States, in naval petroleum reserves, in acquired lands recently transferred from the Department of Agriculture to the Department of the Interior under section 402 of the President's Reorganization Plan No. 3 of 1946, and in all Indian lands subject to departmental jurisdiction, both tribal and allotted, except those of the Osage Nation, in Oklahoma. During the year these duties were accomplished through 20 field offices and suboffices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

On public lands 10,898 oil and gas properties were under supervision at the end of the fiscal year, covering 8,071,261 acres in 22 States and Alaska, an increase of 25 percent in the number of properties and 34 percent in the acreage under supervision over that at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 587 wells and the completion of 608 wells; of these, 450 were productive of oil and gas, and 158 were barren. In all, 14,297 public-land wells, including 6,927 capable of producing oil and gas, were under supervision on June 30, 1947. The production from petroleum deposits of the public lands during 1947 was substantially greater than in 1946.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 22 new unit plans during the year and the termination of 17 previously approved unit plans, leaving 137 approved plans, covering 1,810,477 acres, outstanding on June 30, 1947. About 53 percent of the petroleum obtained from public lands during the year was produced under approved unit agreements, 62 percent of the natural gas, and 74 percent of the gasoline and butane. In addition two Indian-land unit agreements covering a gross area of 36,710 acres were in effect during the year. There were also 33 drilling-unit agreements approved prior to June 30, 1947; these agreements involve isolated small tracts, which are consolidated to form a logical drilling unit and, in effect, constitute an agreement similar to a unit agreement, though involving only a small section of a single field or pool.

On Indian lands the work of supervising oil and gas leases involved 5,662 leaseholds in 12 States, containing at the end of the year a total of 7,764 wells; of these, 4,144 were productive of oil or gas, and 373 had been completed during the year.

On behalf of the Navy Department, supervision was continued in 1947 over operations for the production of oil, gas, gasoline, and butane from 21 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 290 active wells on this reserve aggregated 3,707,500 barrels of petroleum, 3,775,000,000 cubic feet of natural gas, and 8,721,000 gallons of natural gasoline and butane, having an aggregate royalty value of $894,946.

On War Department lands in the Rio Vista gas field the work included the consideration and approval of the participating percentages for a number of these lands and the computation of royalties due the United States. The gas production allocated to these lands amounted to 4,197,098,000 cubic feet, with a royalty value of $276,100.

WORK ON PUBLICATIONS

Texts

During the year, 65 new manuscripts were received by the Section of Texts, 64 manuscripts were sent to the printer, and 80 publications were delivered. Work on these included 3,405 pages of manuscript edited and prepared for printing; 1,141 galley proofs and 6,769 page proofs revised and returned; indexes prepared for 23 publications, covering 2,850 pages and consisting of 4,260 index entries. Copy edited in preparation for mimeographing included 22 press releases, consisting of 42 pages, and 78 pages of miscellaneous material.

Reports delivered were as follows: Professional Papers 142–H, 205–C and D, 206, 207, 209, 210–A to D, 212, 214–A; Bulletins 945–F and G, 946–F, 947–B to G and index, 950, 951, 952, 953–B; Water-Supply Papers 915, 920, 943, 969, 985, 986, 988, 989, 993, 994, 996, 1001, 1002, 1003, 1005, 1006, 1008, 1012, 1013, 1015, 1017, 1037 to 1041, 1044. These cover a wide range of subject matter—general geology of particular areas; mining districts and local mineral deposits in the United States, Alaska, Mexico, and Haiti; studies of fossils and the rocks in which they are found; a collection of papers on geochemical research; measurements of streamflow and of water level and artesian pressure in wells; general studies of underground water and of the occurrence of floods, with consideration of the influence of geology and physiography; and a bibliography of North American geology for the years 1944 and 1945.

In order to keep the public informed, a list of new publications was issued each month. Also printed during the year were a general list of all book publications issued up to May 1947, a circular giving general information concerning maps and folios published, and 12 State index circulars indicating maps and reports for California, Florida, Indiana, Maine, Nevada, North Dakota and South Dakota, Ohio, Oklahoma, Pennsylvania and New Jersey, and Tennessee; also Alaska and Puerto Rico.

Illustrations

Illustrations were prepared for five professional papers, six bulletins, and eight water-supply papers. These consisted of 127 maps, 343 geologic sections, 225 diagrams, and 249 photographs, a total of 944, which were transmitted for printing by chromolithography, photolithography, zinc etching, offset, halftone, and collotype. The Section of Illustrations also prepared or supervised the preparation of illustrations for reports showing the results of cooperative investigations in the American republics, some of which were returned for printing by the other republics.

Geologic Maps

During the year, 537 geologic maps, charts, diagrams, and other illustrations were prepared by the Section of Geologic Cartography for multicolor and black-and-white reproduction. The geologic map of Idaho, printed in 16 colors, was delivered in March; the geologic map of Washington, D. C., and vicinity, printed in 4 colors, was delivered in June. Of the series of multicolor maps of the Missouri Basin, five were completed and printed, three others were in the hands of the printer at the end of the year, and five were in various stages of preparation. For the report on Alaskan volcano investigations, seven multicolor geologic maps and one black-and-white map were prepared by the Section of Geologic Cartography and printed by the Army Map Service. Other geologic maps in proof or in various stages of preparation are colored maps of Borah Peak quadrangle, Idaho; Trans-Pecos area, Texas; and Upper Blue River area, Colorado. The black-and-white map of eastern and southern Utah was completed and sent to the printer. Work on geologic maps of nine quadrangles of the coast ranges in California was nearly completed by the end of the year.

On most of the maps to be printed in color, the section prepared the color separation sheets by sticking on cellophane patterns, thus eliminating most of the hand transfer work formerly done in the Division of Map Reproduction.

The geologic map editor, in addition to critically reviewing the geologic maps prepared in the Section of Geologic Cartography, edited 242 maps and figures prepared in the Section of Illustrations for publication in professional papers and bulletins; 26 maps and charts prepared for water-supply papers; 33 maps and figures drafted in field and section offices for outside publication; and 87 maps and figures planned for publication by the Geological Survey but not yet drafted.

During the year plans were completed for publishing a new series of multicolor State index maps. Each map shows the areas covered by published geologic maps for that State, and a list of the maps and geologic reports is printed in the margin. At the end of the year, the Wyoming index, the first map of this series, was in proof; a second map was ready for the printer, and a third was in preparation.

Map Reproduction

During the year the Division of Map Reproduction printed 44 newly engraved topographic maps, 168 multicolor topographic maps, 5 planimetric maps, 24 preliminary geologic maps, and 54 special maps, making a total of 295 new maps printed and delivered. Reprint editions of 369 engraved topographic maps, 12 multicolor maps, and 184 photolithographed State geologic maps and planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 860 different editions, amounting to 2,190,660 copies were delivered.

A large amount of work was done for 60 other units of the Government, including branches of the Geological Survey and States; the charges for it amounted to about $195,229, for which reimbursement was made to the appropriation for engraving and printing geologic and topographic maps.

Transfer impressions and velox and plate prints numbering 766 were made during the year, and the amount turned over to miscellaneous receipts was $1,035.04.

The total number of copies of topographic maps and of contract and miscellaneous work of all kinds, printed and delivered, was 3,260,251.

The photographic laboratory made 8,106 negatives, 39,797 prints, 2,992 photolith press plates, 34 intaglio etchings, mounted 1,263 prints, developed 17,350 feet of aeromagnetic film, and printed 11,100 feet of aeromagnetic film.

The Division of Map Reproduction was made a part of the Topographic Branch as of July 1, 1947.

Distribution

The Division of Distribution received during the year a total of 1,005 publications, comprising 66 new book reports and pamphlets and 3 reprints; 21 preliminary maps and charts in the oil and gas investigations and strategic minerals investigations series; 297 new or revised topographic and other maps (11 of which were first published as preliminary editions); 56 Tennessee Valley Authority maps with contours; 562 reprinted maps (topographic, advance sheets, indexes, and planimetric). The total units received numbered 109,007 books and pamphlets (including reprints), 34,500 copies of revised index maps, and 2,114,643 topographic and other maps, a grand total of 2,258,150.

The Division distributed 129,320 books and pamphlets, 3,104 geologic folios, and 1,479,028 maps, a grand total of 1,611,452, of which 2,695 folios and 1,277,784 maps were sold.

The net proceeds from sales were $131,499.54 for maps and $1,214.20 for geologic folios. In addition $21,273.98 was repaid by other Government agencies for maps or folios furnished. The total net receipts, therefore, were $153,987.72. Local sale of maps to private individuals jumped from $5,747.09 to $6,753.46, which meant rendering service to 9,097 people. The Division handled 64,798 letters, an increase of 18,215.

On July 1, 1947, the Division of Distribution became a part of the Topographic Branch.

LIBRARY

The year ending June 30, 1947, was an extremely active one for the Library. The readjustment from emphasis on military utilization of library resources to the normal activity of peacetime was no problem, but the extra volume of work entailed in the reestablishment of exchanges and in the processing of materials released as a result of the end of hostilities has been a serious burden.

Our publications are again being sent to all of our former exchanges except those in Germany, Yugoslavia, Bulgaria, and Japan, where exchange facilities have not yet been established. Each of our former correspondents has been written and the response has been good except from Russia. A great deal of material has already arrived from Europe, in most cases completing our holdings by supplying all material published since the break-down of all exchanges in 1940.

The flow of foreign accessions and the revival of suspended domestic publications is shown in the statistics on accessions. More than 17,000 books, pamphlets, periodicals and serial parts, and 2,000 maps were received during the year. This is 5,100 more text items and 1,300 more maps than last year.

There was a slight decrease in the number of persons who used the library this year, about 500 fewer visits than last year, but during the same time almost 4,000 more loans were made for use outside the library. This is evidence of a problem which is of increasing importance in the growing demand for material to be sent to men in the field. The library has always loaned books and other publications to the geologists and topographers in the field, but with the program of decentralization under way this service has taken on a new aspect. With men permanently in the field the character of library service they need is radically changed. They need more books and need them for longer periods.

To give the large group at Denver better facilities, a library was established in the Geologic Branch's Denver Office. A complete set of Survey publications, a good run of the most important geologic journals, and a few books were supplied by the Survey Library to the Denver office. A number of the men stationed at Denver have generously deposited their own libraries with the branch library, making a good start for a reference collection. However, the staff at Denver still has to depend to a large extent on the Washington library, and the other field offices depend on it almost entirely.

Loans of our material to other libraries increased during the past year, and we borrowed more material from other libraries than during the previous year, although not to the extent that we did during the war. This borrowing from other libraries, principally the Library of Congress, was largely for the Section of Military Geology.

The Bibliography of North American Geology, 1944 and 1945, published as Bulletin 952, was delivered in May.

Effective July 1, 1947, the library was placed under the administrative jurisdiction of the Geologic Branch.

FIELD EQUIPMENT

A supplementary instrument shop has been established at the Denver (Colorado) Federal Center, to assist the Division of Field Equipment in maintaining the Geological Survey's field instruments in good repair. Three trained instrument makers and one property clerk were transferred to that shop. Development of new items of equipment was practically discontinued during the year because of the great amount of instrument repair work resulting from the expansion of field activities and the time required in the training of new assistants. The only significant new development work was done in cooperation with the research staff of the Topographic Branch in the redesign of a plotting machine originally designed by Mr. H. T. Kelsh of the Soil Conservation Service. The "Kelsh plotter" is similar to "Multiplex" equipment in that it makes use of aerial photographs in the production of contour maps.

The Division of Field Equipment was transferred to the Topographic Branch as of July 1, 1947.

FUNDS

During the fiscal year 1947 there was available for obligation under the direction of the Geological Survey a total of $18,633,415. Of this amount $9,511,605 was appropriated directly to the Geological Survey, and $9,121,810 was made available by other Federal agencies and by States and their political subdivisions. In addition, $14,950 was allotted from the appropriation for contingent expenses of the Department of the Interior for miscellaneous supplies.

Funds available to the Geological Survey in fiscal year 1947 from all sources

Administrative salaries and expenses:		
Interior Department Appropriation Act	$268, 070	
Supplemental appropriation	33, 800	
		$301, 870

Funds available to the Geological Survey in fiscal year 1947 from all sources—Con.

Topographic surveys:		
Interior Department Appropriation Act	$3,000,000	
States, counties, and municipalities	695,986	
Bureau of Reclamation	719,613	
Public Roads Administration	47,291	
Navy Department	53,189	
War Department	2,033,475	
Miscellaneous repay	95,657	
		$6,645,211
Geologic surveys:		
Interior Department Appropriation Act	2,000,000	
States, counties, and municipalities	71,906	
Republic of Chile	7,924	
Bureau of Reclamation	343,258	
Bureau of Mines	56,446	
Navy Department	6,918	
State Department	144,941	
War Department	469,990	
Miscellaneous repay	12,558	
		3,113,941
Mineral resources of Alaska:		
Interior Department Appropriation Act	200,000	
Navy Department	144,303	
War Department	90,000	
Miscellaneous repay	4,121	
		438,424
Gaging streams:		
Interior Department Appropriation Act	2,498,672	
Supplemental appropriation	90,000	
States, counties, and municipalities	1,936,481	
Permittees and licensees of Federal Power Commission	36,566	
Bureau of Reclamation	804,109	
Office of Indian Affairs	9,509	
Office of Land Utilization	33,300	
State Department	97,263	
Tennessee Valley Authority	80,000	
War Department	755,718	
Miscellaneous repay	24,742	
		6,366,360
Classification of lands:		
Interior Department Appropriation Act	275,000	
States, counties, and municipalities	1,511	
Bureau of Reclamation	121,965	
Miscellaneous repay	5,728	
		404,204
Printing and binding: Interior Department Appropriation Act		110,000

Funds available to the Geological Survey in fiscal year 1947 from all sources—Con.

Preparation of illustrations:		
Interior Department Appropriation Act	$32, 030	
Supplemental appropriation	4, 100	
		$36, 130
Engraving and printing geologic and topographic maps:		
Interior Department Appropriation Act	300, 000	
Miscellaneous repay	195, 229	
		495, 229
Mineral leasing:		
Interior Department Appropriation Act	625, 000	
Supplemental appropriation	25, 000	
Navy Department	20, 000	
Office of Indian Affairs	805	
Miscellaneous repay	1, 308	
		672, 113
Arkansas River Compact		12, 629
Payments from proceeds of sale of water, special account		4, 142
Payments from proceeds of sales of motor-propelled vehicles, etc., special account		33, 162
Total funds available		18, 633, 415

Coal Mines Administration

CAPTAIN N. H. COLLISSON, ADMINISTRATOR

GENERAL ORGANIZATION

THE fiscal year 1947 may be said to encompass almost the entire active life of the Coal Mines Administration, although the organization actually came into being with the issuance of Order No. 2199 of the Secretary of the Interior, dated May 21, 1946, and the bituminous-coal mines were placed under seizure effective 12:01 a. m., May 22, 1946. Work was resumed on June 3, 1946.

On May 21, 1946, under authority of section 3 of the War Labor Disputes Act, President Truman issued Executive Order No. 9728, granting broad powers to the Secretary of the Interior for the seizure and operation of the mines and authorizing him to bargain with duly qualified representatives of the employees for changes in terms and conditions of employment. Approximately 2,600 mines were seized the same day and conferences between the Secretary and the president of the union began the next day. On the 29th of May, a new contract, known as the "Krug-Lewis agreement," was signed.

The significant changes in terms and conditions of employment effected by the Krug-Lewis agreement were as follows: (1) A levy of 5 cents a ton on all coal produced, to be accumulated as a health and welfare fund for the benefit of the miners; (2) a Federal Mine Safety Code, to be formulated by the Director of the Bureau of Mines and placed in effect by the Coal Mines Administrator with respect to all mines in Government possession; (3) the Coal Mines Administrator undertook to have made a comprehensive study of hospital and medical facilities and housing conditions in mine communities; (4) wages of mine workers were increased 18½ cents per hour; and (5) provision for retroactive, pro rata vacation pay. Several other changes of minor nature were made.

After the signing of the contract nonunion mines and mines whose workers were members of unions other than the United Mine Workers of America were released from seizure. These mines had generally resumed work. The sole purpose of seizure was the resumption of production of coal and this aim had been practically accomplished when these mines resumed work.

Admiral Ben Moreell, United States Navy, had been designated Coal Mines Administrator and a staff of about 250 persons, most of whom were naval officers and enlisted personnel, were assigned to various phases of the organization. On October 1, 1946, Capt. Norman H. Collisson, USNR, succeeded Admiral Moreell as Coal Mines Administrator, serving continuously from that date to September 1947.

Constant efforts were being made by the Coal Mines Administration to end the necessity for Government operation by encouraging some form of agreement between the coal operators and the union. A meeting between the operators and the union was convened in Washington, September 11, 1946, without any progress being made. Again on October 19, 1946, the Secretary of the Interior obtained an agreement from the president of the union to attend any conference which might be called with the operators. Upon the urging of the Coal Mines Administrator, a committee representing the operators met in Washington, December 19, 1946, for the purpose of reopening negotiations with the union. Both these meetings failed, due to the fact that the segments of the operators could not agree; and it was not until May 1947 that it was possible to bring the union and all groups of operators together for a series of meetings, which finally resulted in a contract being signed 10 days after the return of all mines to their owners on June 30, 1947.

DECEMBER 1946 STRIKE

On October 21, 1946, the president of the United Mine Workers of America wrote the Secretary of the Interior, stating that interpretations of the Coal Mines Administrator concerning pro rata vacation pay and the method of determining weights upon which payments to the welfare-and-retirement fund were computed, constituted a breach of the Krug-Lewis agreement. He further stated that significant changes in Government wage policy had occurred since the execution of the Krug-Lewis agreement and that the union requested a conference in Washington, D. C., on November 1, 1946, for the purpose of negotiating new arrangements affecting wages and hours and other terms and conditions of employment.

The Coal Mines Administrator, on October 22, 1946, replied, pointing out that, among other things, the Krug-Lewis agreement specifically provided that it was to extend for the period of Government possession and that this clause superseded section 15 of the 1945 agreement, upon which the union relied to reopen the Krug-Lewis agreement. Several other letters and telegrams were exchanged between the Secretary of the Interior and the president of the United Mine Workers, and a series of meetings was held between representatives of the Government and the union without agreement upon any essential features of the controversy. The president of the United Mine Workers of America notified the Secretary of the Interior on November 15, 1946, that he would consider the Krug-Lewis agreement terminated as of midnight, November 20, 1946. The Secretary replied, stating that the notice of contract termination was without legal effect.

The union maintained its stand, a walk-out began, and on November 18, 1946, the Government filed a suit in the United States District Court for the District of Columbia against the United Mine Workers of America and John L. Lewis, individually, and as president of the union, seeking judgment to the effect that the defendants had no unilateral power to terminate the Krug-Lewis agreement. The court issued an order restraining the defendants from continuing in effect the purported notice of contract termination of November 15, 1946. The union ignored the court's order and, by November 20 production was practically suspended. The union and Mr. Lewis were then tried for contempt of court beginning November 27, 1946, both were found guilty, Mr. Lewis was fined $10,000 and the union $3,500,000. The union appealed the decision, but on December 7, 1946, suspended the strike until March 31, 1947. On March 6, 1947, the Supreme Court confirmed the conviction, but reduced the fine to the union to $700,000, conditional on the union having purged itself of contempt within a reasonable time. On March 17, 1947, the union, by its president, in a letter to the Secretary of the Interior, unconditionally withdrew its purported notice of contract termination and, with the exception of the "mourning period" and safety strikes in April 1947 following the Centralia disaster, no other work stoppages occurred other than the usual sporadic or "wildcat" strikes.

OPERATIONS FOR THE ACCOUNT AND RISK OF THE GOVERNMENT

The system which was generally adopted in compliance with the President's Executive Order No. 9728 was that the former manager of a mine was appointed operating manager for the United States and continued to function under the orders and directions of, and subject to removal by, the Coal Mines Administrator. Such operations were for the account and risk of the owners of the mines. In approximately 2,500 mines under seizure most of these operating managers reasonably observed the orders and directives of the Coal Mines Administrator, and the mines continued to function under the same management.

In the case of two companies the operating managers refused to comply with directives of the Coal Mines Administrator and it became necessary to operate the mines of the companies for the account and risk of the Government. Thus on January 1, 1947, the Coal Mines Administrator commenced operations of the mines of the Carter Coal Co. at Coalwood and Caretta, W. Va., and, on January 6, 1947, mine No. 3 of the Fox Coal Co. at Morgantown, W. Va., for the account and risk of the Government. These operations continued until the termination of Government possession of all mines on June 30, 1947.

MEDICAL SURVEY

To accomplish the health and welfare survey provided for in the agreement, Rear Adm. Joel T. Boone (MC), United States Navy, and a staff of approximately 50 medical and engineering personnel were detailed to the Coal Mines Administration and spent several months inspecting various coal fields. Typical mining communities were sampled, with many thousands of photographs taken by special coordinated traveling teams; and all features, good and bad, of these typical communities were scrutinized from the standpoint of housing, medical facilities, sanitation, and personal living habits and reported upon by these trained observers.

The results were edited and assembled into a voluminous report entitled "A Medical Survey of the Bituminous-Coal Industry." The report was received with approval as the first comprehensive effort to arrive at a fair complete presentation of conditions as they actually exist in the coal-mining industry.

A selected group of the photographs used in the report was enlarged in display form and arranged with suitable charts and exhibited in the Library of Congress during May 1947 It is estimated that some 12,000 persons viewed the exhibit.

SAFETY CODE

Among the responsibilities assumed by the Coal Mines Administrator under the Krug-Lewis agreement was that of enforcing a new Federal Mine Safety Code to be formulated by the Director of the Bureau of Mines. The code was published on July 24, 1946, and placed in effect by the Coal Mines Administrator on July 29, 1946. This code included all of the known features and requirements of safe operations of mines based on the experience and observation of years. It is significant that it was continued in effect as a part of the new contract for 1948 between the operators and the union.

A safety division of the Coal Mines Administration gave its constant and almost exclusive attention to the correction of unfavorable safety conditions during the period of Government possession of the mines. Records of the Administration show that 40,301 safety violations were corrected during this period as compared to an average of 3,000 violations reported corrected in similar periods prior to Government seizure.

A tragic disaster occurred in the mine of the Centralia Coal Co., Centralia, Ill., on March 25, 1947, resulting in the death of 111 men. Thorough investigations made by various boards, including a United States Senate subcommittee, failed to attach blame or negligence to the Coal Mines Administrator for lack of enforcement.

The results experienced in the year of operation of the mines under Government seizure and subject to the provisions of the Federal Mine Safety Code will permanently benefit mine safety and advance safety practices by many years.

WELFARE AND RETIREMENT FUND

The Krug-Lewis agreement created for the first time in the history of bituminous-coal mining in this country a welfare and retirement fund effective for those mines in Government possession. It required that each operating manager pay into the fund an amount equal to 5 cents per ton of coal produced for use or for sale.

Pending the permanent appointment of trustees and the accumulation of moneys into this fund, the United Mine Workers of America and the Coal Mines Administrator, on June 27, 1946, designated the Paymaster General of the United States Navy as temporary custodian of this fund.

On December 30, 1946, the Coal Mines Administrator was advised by the United Mine Workers of America that the union's international executive board had designated John L. Lewis as its trustee on June 19, 1946.

The Secretary of the Interior recommended that the Coal Mines Administrator appoint himself one of the trustees, and such appointment was made on January 22, 1947.

On March 30, 1947, Mr. Lewis and Captain Collisson, as trustees of the welfare and retirement fund, agreed upon the selection of Mr. Thomas E. Murray of New York City as the third trustee. The trustees held their first meeting on April 8, 1947, and on April 14, 1947, the custodian transferred to the board of trustees $18,177,852.50, the total amount collected during the period January 1, 1946, to April 14, 1947. Thereafter, moneys for the fund were received directly by the trustees. During the period June 1, 1946, to June 30, 1947, coal was produced in an amount requiring a total payment into the fund of $25,852,990.13.

As of the date of this report, Captain Collisson is still serving as trustee of the fund, but has notified the other trustees of his intention to resign as promptly as a legal procedure may be agreed upon to make the resignation possible.

Throughout the period of administration of this fund by the trustees, regular payments were made in specific cases among which was the payment of $1,000 to the survivors of all members of the United Mine Workers of America who died on and after May 21, 1946.

CLERKS, TECHNICAL AND SUPERVISORY EMPLOYEES

Section 11 of the Krug-Lewis agreement provided that, with respect to the status of supervisory employees, the Coal Mines Administrator would be guided by the decisions of the National Labor Relations Board. The Board, on May 27, 1946, certified district 50 of the United Mine Workers of America as the bargaining agent for supervisory employees of the Jones & Laughlin Steel Corp. On June 12, 1946, the corporation filed a suit for a restraining order against the Board, the Secretary of the Interior, the Coal Mines Administrator, and others in the United States District Court for the District of Columbia. On June 26, 1946, the company's plea was denied and the suit dismissed. Although this decision was appealed to higher courts, the Coal Mines Administrator, pursuant to the provisions of section 11 of the Krug-Lewis agreement, negotiated a contract covering terms and conditions of employment with the clerks, technical and supervisory division (district 50) of the United Mine Workers of America. This contract was signed July 17, 1946, and shortly thereafter ordered in effect by the Coal Mines Administrator in the mines of the Jones & Laughlin Steel Corp., and in certain other specific instances.

TERMINATION

By virtue of the President's proclamation declaring termination of hostilities effective December 31, 1946, section 3 of the War Labor Disputes Act became void 6 months later, and the Coal Mines Administration automatically was required to terminate its activities on June 30, 1947. Six hundred and seven million tons of bituminous coal had been produced during the preceding 12 months, the second highest production record in the Nation's history and valuable lessons had been learned in the operation of the mines.

Prior to the final termination date, official notices and orders of termination were sent out under the signature of the Secretary of the

Interior to all operating managers of mines under seizure, and the various companies whose mines had been seized were invited to sign mutual releases of claims as between themselves and the Government arising out of seizure. By the middle of August 1947, 1,138 of the 1,541 mines still under seizure on June 30, 1947, had signed some form of release either with or without reservations.

Commencing on July 1, 1947, the Coal Mines Administration began the liquidation of its principal activities within 60 days and continued a small skeleton organization of five persons under the supervision of the War Agency Liquidation Administration for the fiscal year 1948. One of the principal tasks was to settle, insofar as possible, claims for use and occupancy arising out of the Carter Coal Co. and Fox Coal Co. operations for the account and risk of the Government.

The United Mine Workers of America and the majority of the bituminous-coal operators of the United States entered into a contract effective July 1, 1947. This contract, arrived at through collective bargaining maintained the great majority of the provisions of the Krug-Lewis agreement. The welfare fund payment was increased to 10 cents a ton and other concessions were granted to the miners, including wage increases and shorter hours.

Oil and Gas Division

MAX W. BALL, DIRECTOR

THE Oil and Gas Division, established by the Secretary of the Interior by Order No. 2193 of May 6, 1946, made substantial progress toward the accomplishment of its basic objectives during the first full year of its existence. At the same time, developments in the field of petroleum emphasized the peacetime essentiality of a central oil and gas agency.

The principal responsibilities of the Division are to coordinate and unify policy and administration in respect to Federal petroleum functions and activities; to serve as the liaison agency and channel of communication of the Federal Government in its relations with State oil and gas bodies and with the petroleum industry; to assist the Secretary in discharging his duty to keep the President informed with respect to the adequacy and availability of petroleum to meet the current and future needs of the Nation and with respect to such action as may be necessary to safeguard the Nation's petroleum future, and to administer the Connally "Hot oil" Act.

As the Division organized to discharge its responsibilities, urgent oil and gas problems of national significance arose. For the first time in modern peacetime petroleum history, both domestic and world-wide petroleum demand exceeded available supply, with consumption of both oil and gas greater than at the peak of the war and increasing steadily. Local shortages of petroleum products, including gas, occurred in various parts of the United States, and such shortages threaten to become more frequent and widespread and to continue as a major problem for the next several years.

The extreme difficulty of the military forces and of essential public services in obtaining their minimum petroleum requirements have created and continue to create problems of national significance. Assistance by the Division in meeting this situation has been and continues to be one of its major activities. The Division has directed its efforts to assuring that appropriate petroleum activities of agencies in the Federal Government are so directed as to minimize the extent, duration, and severity of the shortages and to overcome the basic causes thereof.

An abundant and readily available supply of petroleum products at reasonable prices is basic alike to the national economy and to national and hemisphere security. Thus, as important as are the immediate shortages, they are but symptomatic of the more serious and more urgent long-range problem of assuring an adequate future petroleum supply for the United States. This problem involves not only the continued availability of crude oil and natural gas in adequate quantities for an indefinite period, but also the vast and complex facilities required for making these raw materials available to consumers in the proper kinds and at the proper places. In addition, the involved technical and economic aspects of synthetic fuel production and access to foreign oil resources are integral parts of the problem which must be fitted into the over-all solution.

Nearly 40 Government bureaus and other agencies have activities that affect or depend upon oil and gas supply. The activities of each are confined to one or more specialized phases of the vast and complex petroleum situation. Only Oil and Gas Division keeps in touch with the situation as a whole, and attempts through advice and persuasion, without mandatory authority, to coordinate in the public interest the petroleum activities of the specialized Government agencies, the State regulatory and conservation bodies, and the oil and gas industry. The Oil and Gas Division, alone among Federal agencies, deals with the over-all mechanics and economics of oil and gas demand and supply and the broad relationships of petroleum to the national welfare and security.

In order to assist in discharging its responsibilities for the coordination and unification of Federal petroleum functions and activities, an interdepartmental petroleum committee has been established and has functioned with outstanding success. The membership thereon is held by the military, diplomatic, and civilian agencies of the Government having basic petroleum interests or responsibilities. The committee serves as a focal point for the consideration of oil and gas problems affecting more than one department or agency as well as for the consideration of improved Government petroleum organization and developments of national importance in the field of oil and gas.

LIAISON WITH STATE BODIES

In addition to direct relations with State conservation and regulatory bodies, especially through the members and examiners of the Federal Petroleum Board, the Division is represented by nonvoting membership on the Interstate Oil Compact Commission. Through these relationships mutual problems of supply and demand, waste, conservation, and increased recovery are considered, respective and mutual fields of interest are defined, and cooperative action is taken where advisable, as in the holding of a Nation-wide secondary recovery forum, sponsored jointly by the Division and the Compact Commission. These contacts and activities keep the Federal Government in touch with State problems and practices, and help to substitute cooperation for conflict.

LIAISON WITH THE INDUSTRY

National Petroleum Council.—Wartime experience demonstrated the essentiality of cooperative relations between Government and industry in dealing with a field so important and complex as oil and gas; relationships through which the Government could obtain the practical knowledge and experienced counsel of experts in the field. The National Petroleum Council was established therefore, at the express suggestion of the President, to serve as the principal channel of communication and liaison agency with the industry. Through this Council is continued, to the extent appropriate in time of peace, the cooperation between the Government and the industry that contributed so much to winning the war. The Council is made of 85 men, chosen and appointed by the Secretary of the Interior, representing every functional and geographic division of the industry. Its membership includes heads of oil and gas companies large and small, representatives of trade associations, and individual producers, refiners, transporters, and marketers. The council and its committees make available to the Government the industry's invaluable knowledge and wisdom. During the fiscal year 1947 a total of 261 members served on Council committees and subcommittees, gathering information for or otherwise serving the Oil and Gas Division.

Military Petroleum Advisory Committee.—Because of the basic and pervasive importance of petroleum in war, and the highly secret character of emergency planning, a separate industry advisory group has been established to function in this field and to act as expert advisers to the military and the Oil and Gas Division on petroleum preparedness and mobilization, both civilian and direct military. This group, the Military Petroleum Advisory Committee, is at present composed of 17 outstanding experts in the various functional aspects of petroleum operation. At the request of and under the direction of the armed services and the Oil and Gas Division, it is already engaged in the collection of essential data and the development of emergency programs and policies for submission to governmental authorities on oil and gas matters relating to the national security and defense.

CONNALLY ACT ADMINISTRATION—FEDERAL PETROLEUM BOARD

Administration of the Connally Act was transferred to the Oil and Gas Division by Executive Order 9732, June 3, 1946. The basic administration of the act is largely a field problem, centralized in the Federal Petroleum Board, established under the Connally law as the successor agency to Federal Tender Board No. 1. The Board operates under the supervision of the Oil and Gas Division. The Board has its principal office at Kilgore, Tex., with sub-offices at Midland and Houston, Tex., and Lafayette, La. The suboffice at Corpus Christi was closed at the end of the fiscal year. The Board enforces regulations under the Connally law and directs a small force of field examiners who make physical inspections of producing leases and transportation and processing facilities and investigate and report on violations of the Connally law within areas in which there are State laws and regulations regarding the conservation of oil, in order to prevent the shipment of contraband oil in interstate commerce.

Examiners of the Federal Petroleum Board made more than 5,300 field inspections of oil-producing properties, 20 inspections of gas plants, refineries, and reclamation plants, and 19 inspections of pipeline systems in the first 10 months of the fiscal year. Sharp reductions in the field personnel and the necessary placing of other employees on leave with and without pay virtually eliminated field inspections during the 2 final months of the fiscal year. Many of the lease inspections involved the gaging of all oil on hand. These examiner activities were largely preventive in nature. When minor irregularities were called to the attention of operating executives or State officials they were usually corrected and Connally law violations prevented.

Cooperation with State authorities.—Constant contact is maintained between examiners of the Federal Petroleum Board and agents of the State enforcement bodies with frequent conferences regarding production allowables and practices and the movements of oil. The Board examiners on numerous occasions have advised State agents regarding irregularities in production or transportation procedures. The prompt correction of such irregularities has prevented the development of serious infractions of law and regulations, as well as waste. In addition to these contacts between the Board examiners and the State agents the Board members have conferred with members of the Railroad Commission of Texas and other State conservation authorities.

Personnel.—As of July 1, 1946, the Board's personnel consisted of 49 persons. As of the end of the fiscal year, because of anticipated reductions in appropriations and matters related thereto, the number of employees was reduced to 14. At the close of the fiscal year, some reinstatements were in progress and it was anticipated that the staff during the succeeding fiscal year would total 29 persons, 16 of whom would be field examiners. In line with this reduction in personnel, the auditing of operator's report will be discontinued and the reporting requirements will be suspended in many areas.

Connally law cases.—At the beginning of the 1947 fiscal year, 10 Connally law cases were under investigation or were awaiting court action and 10 additional cases were inaugurated during the year. Of these 20 cases, 6 were under continued investigation by the Board at the close of the year; 4 were with the Department of Justice; 2 with the Solicitor's Office of the Department; 2 were closed by pleas of guilty; 2 were concluded by the Board, and 1 by the Department of Justice without court action; 1 case became moot when defendant submitted the required reports to the Board; 1 defendant was found not guilty; and in 1 case the Federal grand jury did not return an indictment. In the two cases where pleas of guilty were entered, the defendants were assessed and paid fines totaling $3,500.

The incentive to produce contraband oil—oil produced in excess of allowables issued by State authorities—increases as the price of oil goes up and when demands reach such high levels that any transportable barrel of crude oil can find an immediate market. Likewise, when the oil fields already are producing at their maximum efficient rate, as most of those in the United States now are doing, the damage done to the fields is greater than when the fields had a margin of safe productive capacity, as they did have before the war. Inasmuch as the purpose of the Connally law is to aid the States in their conservation enforcement, by prohibiting the use of interstate facilities for the shipment of contraband oil, any lessening of this Federal activity at this time of greater need will prove particularly harmful.

Office of Land Utilization

LEE MUCK, ASSISTANT TO THE SECRETARY

THE Office of Land Utilization has completed its seventh full year as the coordinating agency for the land and water conservation and development programs of the Department of the Interior. During the year the Office continued to direct the soil and moisture conservation program of the Department, coordinated the forest management programs on the Department's lands, carried on the staff work of the Water Resources Committee and the land classification activities of the Office of the Secretary, and terminated the wartime Civilian Public Service camps on lands administered by various agencies of the Department.

SOIL AND MOISTURE CONSERVATION

The soil and moisture conservation program of the Department of the Interior is an important segment of the national soil conservation program authorized by the Soil Conservation Act of April 27, 1935. Its purpose is the reduction of soil and water losses on lands under the jurisdiction of the Department. These lands comprise a major part of the invaluable watersheds and range areas upon which the economy of the West is so vitally dependent.

Approximately 44 percent of the Interior lands has been classified as badly damaged and seriously in need of rehabilitation and better management. Many critically eroded areas are on watersheds above important irrigation projects and the sediment from these areas constitutes an ever increasing menace to the proper functioning of the projects and to the economy developed from them. Furthermore, the present depleted condition of these lands is a definite hindrance to the development of a sustained economy by the range livestock industry.

During the 6 years the program has been carried on under the supervision of the Office of Land Utilization much has been accomplished in restoring depleted lands and in mitigating the sediment menace. Improved land-use practices are being applied both directly by the Department and in cooperation with other governmental agencies and land operators. Operational plans have been applied on several thousand individual Indian farms. Project operations to restore and improve the vegetative cover on several million acres of range land in the major drainage basins of the West have been initiated. During the past several years effective procedures and practices have been developed for many of the phases of erosion control.

The need for a unified approach to the solution of the problem by all agencies is being emphasized, and the redemption of land management responsibilities is becoming a matter of increasing importance in the conservation of the wealth of the Nation. The cooperation extended to the Department by other land-management agencies, by users of Interior lands, and by owners of adjacent and intermingled lands has been especially gratifying. It has been clearly demonstrated that maintenance of the Nation's irreplaceable soil and water resources is being given greater attention by land owners and managers and that the users of departmental lands are willing and anxious to assist financially and otherwise in promoting and facilitating the work on public lands.

FOREST MANAGEMENT

The Office of Land Utilization, acting under secretarial order, coordinates all activities in forest conservation and management on lands under the jurisdiction of the Department. It has been consistently seeking the consummation of three major objectives, namely: the adequate protection of all the Department's vegetative resources from loss by fire, insects, and diseases; the early completion of such cooperative sustained-yield agreements with owners of forest properties adjacent to or intermingled with departmental forests as are in the public interest; and the adequate technical management of all departmental forests.

The effectiveness of the Department's fire-control program suffered major setbacks during the year through major reduction in funds for grazing district land administration and protection and through a material curtailment of cooperation previously afforded in Alaska by the United States Army. The loss of cooperation in Alaska was immediately reflected in a striking increase in the acreage of forest land burned over during the calendar year 1946.

Funds available to the land managing agencies of the Department for the purpose of fire prevention, presuppression, and suppression during the fiscal year average only 3 mills per acre for all the lands requiring fire protection—6 mills in continental United States and 0.8 mill in Alaska. These rates are inadequate for effective fire protection.

The Office continued its coordination of the white pine blister rust control program, which was expanded considerably during the year. As of December 31, 1946, a total of 393,677 acres had been worked over once, and a total of 210,351 acres were considered to be on a maintenance basis. During the calendar year 1946, initial work was completed on 12,787 acres and rework on 38,581 acres.

As the year closed, the Office of Land Utilization, acting in a liaison capacity between the forest management bureaus of the Department and the Bureau of Entomology and Plant Quarantine of the Department of Agriculture, was engaged in completing initial plans for operations under the new authority provided by the act of June 25, 1947, to establish a coordinated program for control of outbreaks of destructive insects or diseases on or threatening any forest land irrespective of ownership.

Consummation during the year of a 20-year contract for the disposal of about 35 million board feet of birch in Alaska under sound forestry principles, under the technical guidance of the Branch of Timber of the Bureau of Land Management, is the first major step taken toward intensive management of the forests on the public domain in Alaska.

The cooperative sustained-yield forest-management program for the O. and C. revested grant lands proceeded further toward fruition during the year. The Secretary approved on December 11, 1946, the Siuslaw master unit, its appurtenant marketing area, and its annual production capacity on which public hearings had been held December 3, 1945. Public hearings have recently been held for the other 11 master units.

The demand for lumber for postwar construction still continues to be very heavy, and the Department has, within its personnel and fiscal limitations, endeavored to contribute as much as possible. During the year the reports of the respective bureaus show that a total of 1 billion board feet, valued at $5,000,000, were cut and removed from Department of the Interior lands.

WATER RESOURCES COMMITTEE

The fundamental purpose of the Water Resources Committee is to implement the declared policy of the Congress with respect to the consideration of multiple-purpose comprehensive basin developments and to assure that the maximum benefits will accrue therefrom. Consistent with this policy, procedures have been perfected whereby the bureaus and agencies of the Department work in close cooperation among themselves and with appropriate State officials and other Federal agencies to assure that the programs will provide a comprehensive and coordinated development.

The Water Resources Committee reviewed nine specific agency and project reports in the light of the interests of all the agencies of the Department, in addition to its consideration of comprehensive plans by the Bureau of Reclamation and other agencies of the Department for the Central Basin, Calif., and the Colorado and Columbia Basins. The Committee also reviewed nine projects of the Corps of Engineers.

Procedures were formulated whereby the Department Missouri Basin Field Committee, established by departmental order dated May 31, 1946, has expedited and coordinated the Department's vast water-development program in the Missouri River Basin. Problems of immediate concern considered by the Missouri Basin Field Committee and the Water Resources Committee relate to the plans and programs of the various agencies operating in the basin and the relation of these programs, one to the other. In addition, the chairman of the Missouri Basin Field Committee has acted as the representative of the Department on the Missouri Basin Inter-Agency Committee, thus assuring, so far as practicable, coordination of the Department's programs with those of the other agencies represented on the Inter-Agency Committee.

The progress made in the coordination of water-development programs has been encouraging. Much remains to be accomplished, however, before the degree of cooperation essential to river basin development can be completely obtained.

LAND CLASSIFICATION

The Office of Land Utilization reviews actions of the various bureaus involving disposal, reservation, withdrawal, and restoration of public lands which require approval by the Secretary, and recommends actions on appeals from decisions of the Bureau of Land Management denying applications for homesteads, public sales, exchanges, small-tract leases, grazing leases and permits, and other disposal and use of public lands, where such decisions hinge on the suitability of the land for the proposed uses covered by the applications. About 1,000 documents were examined during the year, of which more than 200 were appeals.

The Office cooperated with the Bureau of Land Management in shifting from a basis of equal acreages to equal values in approving State exchanges under section 8 (c) of the Taylor Grazing Act of June 28, 1934 (48 Stat. 1269), as amended, participating in the revision of the regulations to effectuate the change of policy and in the review of pending State exchange applications to determine which could be approved under the new regulations.

In a study of the economic aspects of the gradual filling of Lake Mead with silt, it was estimated that current expenditures of about

$2,000,000 annually would be justified on measures which would prevent the accumulation of silt in the reservoir.

CIVILIAN PUBLIC SERVICE CAMPS

The Civilian Public Service Camp program, which was in process of liquidation at the opening of the fiscal year, was terminated officially on March 31, 1947, and as of that date the last remaining camp on Department of the Interior lands—CPS Camp No. 34, Patuxent Wildlife Research Refuge—was closed. This program, which at its height during the war period, provided upward of 1,800 conscientious objectors for work on forest protection and water conservation on lands of this Department, provided welcome manpower at a time when labor was extremely limited.

Bureau of Land Management

FRED W. JOHNSON, DIRECTOR

SIXTEEN days after the beginning of the 1947 fiscal year the installation of a modern administrative structure for more efficient handling of problems involving the Nation's public land and its natural resources was begun under authority of the President's Reorganization Plan No. 3 of 1946. Orders putting into effect the consolidation of the General Land Office and the Grazing Service into a newly established Bureau of Land Management in the Department of the Interior were issued on July 16, and other steps were ordered taken to integrate the program for management of the 778 million acres of public domain in the United States and Alaska.

The net result of these developments at the inception of the fiscal year was the beginning of a new chapter in public land history whose far-reaching effect will have as important an impact upon national economy as did the earlier epochs in national land administration. Briefly, the program contemplates the furnishing of better service in the administration of the public lands through regionalized handling of cases under revised regulations affording wider opportunity than ever before for resource development under prudent conservation safeguards.

Steady and consistent progress toward the attainment of this goal, while at the same time furnishing adequate service in the handling of its day-by-day administrative problems, constituted the unprecedented dual task which has confronted the Bureau during the past 12 months.

The degree of success which marked its operations during the year is reflected in part by the record-breaking total of more than $21,000,000 in cash receipts from its activities. This cash income was the highest in 66 years of recorded statistics on the subject.

Full appreciation of the many-sided tasks confronting the Bureau during the year only is possible through consideration of the problems involved in both the reorganization and the daily administrative fields of operation.

Highlights of activity in each of these fields are set forth in the pages which follow.

BUREAU REORGANIZATION

Briefly, early steps taken in the advancement of the new program for streamlined public land administration included the following:

The establishment of the Bureau of Land Management through a merger of the General Land Office and the Grazing Service, and the selection of a Director, an Associate Director and an Assistant Director.

Distribution of the work of the new Bureau among six branches, namely, Branch of Adjudication; Branch of Land Planning and Classification; Branch of Range Management; Branch of Timber and Resource Management; Branch of Engineering and Construction; and Branch of Administration.

At the same time arrangements were completed for the transaction of much of the public land business on a regional basis by which on-the-spot service could be rendered without the loss of time heretofore incident to the handling of all cases in Washington. To this end seven strategically located geographical regional offices have been established by the Bureau. Each in charge of a regional administrator, these include:

Region No. 1, encompassing the States of Idaho, Oregon, and Washington, with headquarters at Portland, Oreg.

Region No. 2, Nevada and California, with headquarters at San Francisco, Calif.

Region No. 3, Montana, Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Iowa, and Missouri, with headquarters at Billings, Mont.

Region No. 4, Utah and Colorado, with headquarters at Salt Lake City, Utah.

Region No. 5, Arizona, New Mexico, Texas, Oklahoma, Arkansas, and Louisiana, with headquarters at Albuquerque, N. Mex.

Region No. 7, Alaska, with headquarters at Anchorage.

A proposed region No. 6, containing all States not otherwise allocated, with headquarters in Washington, D. C., had not been established by the end of the fiscal year, problems relating to those areas being administered by the Washington office.

DISTRICT LAND OFFICES

In addition to the advantages afforded by the regional set-up prompt on-the-spot service in the handling of public land administration matters will be provided through the continued maintenance of the 25 district land offices located in 13 Western States and the Territory of Alaska. Serving as the point of origin for practically all of the problems handled by the Bureau during the course of the year, these district land offices are located as follows:

Alaska: Anchorage, Fairbanks, Nome.
Arizona: Phoenix.
California: Los Angeles, Sacramento.
Colorado: Denver, Pueblo.
Idaho: Blackfoot, Coeur d'Alene.
Montana: Billings, Great Falls.
Nevada: Carson City.
New Mexico: Las Cruces, Santa Fe.
North Dakota: Bismarck.
Oregon: Lakeview, Roseburg, The Dalles.
South Dakota: Pierre.
Utah: Salt Lake City.
Washington: Spokane.
Wyoming: Buffalo, Cheyenne, Evanston.

A large amount of the detailed work incident to the transfer of routine operations to these field offices had been completed by the end of the 1947 fiscal year. Further accomplishments under the program had to be postponed at that time, however, because of restrictions against the decentralization program written by Congress in the Interior Appropriation Act for the 1948 fiscal year. Nevertheless, the program for improved administration was brought to the highest point of effectiveness possible under the circumstances. Meantime, special legislation was in course of preparation at the end of the year to permit resumption of the reorganization work in the 1948 fiscal period.

REVENUES

For many years the General Land Office, prior to its consolidation in the Bureau of Land Management, had been one of the few agencies of the Federal Government whose operations have resulted in revenues in excess of the cost of administration.

This record was maintained by the Bureau itself in the 1947 fiscal year, total receipts being $21,012,154, and total expenditures $6,288,030. This surplus of receipts over expenditures out of appropriations represents a ratio of $4.78 for every $1 spent on the operation of the former General Land Office and Grazing Service.

THE YEAR'S WORK

The world need for America's natural resources, coupled with increased demands for the use of the public lands of the United States, placed heavy administrative responsibilities upon the Bureau during the 1947 fiscal year. In addition, a war-accumulated backlog of approximately 50,000 cases laid aside while its depleted personnel force centered its activities upon problems connected with the military program, was partially cleared away during the year's operations.

PROBLEMS OF LAND USE

Homesteads

During the year the continued scarcity of housing accommodations in the United States found its reflection in heavy demands, particularly from veterans of World War II, for home-making opportunities on the Federal public domain.

Overlooking the fact that the good free farm land which was available at the end of the Civil War had practically all passed into private hands many years ago, thousands of persons sought information from the Bureau as to the availability of the public lands for acquisition under the homestead laws.

Except for the farm lands provided through the irrigation program of the Bureau of Reclamation and some portions of the public domain in Alaska, the limited amount of public land suitable for agricultural settlement is indicated by the fact that less than 500 applications for such use throughout the entire United States were approved during the fiscal year.

Small Tracts

The Small Tract Act of 1938 virtually has displaced the original homestead law of Abraham Lincoln's day as the popular method for obtaining public land. Under this law the Secretary of the Interior is authorized to lease or sell not more than 5 acres of surveyed public land for use as a home, camp, cabin, health, convalescent, recreational, or business site. In subsequent legislation Congress gave veterans of World War II preference rights in the filing of applications for such tracts.

Anticipating the demand for this type of land-use the Bureau through various land classification orders made approximately 15,000 acres available for lease in California, an additional 10,000 acres in Arizona, and smaller tracts in New Mexico, while other reports were nearing completion at the end of the year providing for the utilization of areas in Idaho, New Mexico, Nevada, and Wyoming for small tract lease purposes. Meantime, approximately 7,500 applications and 5,000 leases were handled by the Bureau during the year.

The popularity of this type of public land use was materially increased by the Secretary of the Interior near the end of the 1947 fiscal year through the issuance of regulations authorizing the purchase of a tract under certain conditions after 1 year's tenancy under a Government lease. At the same time its scope was enlarged by legislation which made its provisions applicable to the Territory of Alaska as well as to the public lands on the continent of the United States.

Minerals, Timber, and Other Resources

The public lands of the United States continued to contribute their share of the world's supply of natural resource products as the partial result of administrative activities of the Bureau during the 1947 fiscal year. Production of petroleum from the public domain, for example, aggregated 64,043,460 barrels, an increase of 7½ percent over last year, while the total production of natural gas exceeded 97,500,000,000 cubic feet, an increase of 1½ percent over that of 1946. The production of gasoline and butane from the public lands reached 125,584,258 gallons, a rate of increase of 3.9 percent.

Proceeds to the Government from the development of these and other mineral resources under Government lease aggregated more than $16,200,000 during the 1947 fiscal year.

The economic value of sustained yield forestry management operations—the maintenance of a reasonable balance between the volume of tree-cutting and tree growing—is becoming increasingly recognized by both private individuals and Government agencies concerned with the development and production of the Nation's timber resources.

The application of this policy to timber resources on all of the public lands of the United States was authorized in legislation passed by Congress during the 1947 fiscal year and placed added responsibilities upon the Bureau of Land Management for the administration of its provisions. At the same time legislation providing for the sale of other types of materials from the public domain resulted in further increase in the Bureau's work load for the year, and plans for a general sustained yield inventory and the preparation of regulations governing the administration of the new laws had been brought near completion at the end of the fiscal period.

Meantime, the 2,500,000 acres of Oregon and California revested railroad grant lands and reconveyed Coos Bay Wagon Road grant lands in western Oregon continued to afford during the year a striking example of the practical advantages inherent in the sustained yield forestry management program.

With a continuous supply of raw material assured the value of timber from the Oregon and California lands reached an all-time high, the 517,296,000 feet board measure of the timber sold during the year being valued at more than $3,500,000 or twice as much return to the Government as in the 1946 fiscal year.

Plans for the future operation of the timber resources on the public lands in the area were advanced during the year through hearings for the establishment of master sustained yield economic and forestry units under the general supervision of the Bureau.

Surveying

Because no tract of land properly may be set aside for any use until its location and boundaries have been accurately determined and permanently recorded, the Government's cadastral surveys have been the basic foundation in negotiations for the disposal of exchange, withdrawal or other change in the status of the public domain areas since 1786.

During the 1947 fiscal year cadastral activities by the Bureau of Land Management were carried on in 19 States and the Territory of Alaska, a grand total of 2,925,012 acres being surveyed under that program.

Law Division

The legal steps necessary to be taken in connection with the general reorganization plan of the Bureau placed heavy responsibility upon its Law Division during the 1947 fiscal year. Altogether the Division initiated over 3,100 original actions and performed over 27,000 items of review.

Operations of the Bureau resulted in the total collection of $103,562 on trespass claims, more than twice as much as the amount realized in that work in 1946.

Progress in Alaska

Because the extent to which the Federal public lands in Alaska are beneficially utilized is a vital factor in the advancement and maintenance of economic stability of the Territory, the operations of the Bureau in the administration of these lands and their resources were of outstanding importance during the 1947 fiscal year.

Pursuant to the national policy of utmost cooperation in the development of land settlement opportunities and the expansion of industry in the Territory, activities of the Bureau were centered upon an integrated program containing the following highlights of achievement:

Special crews of surveyors and land experts were engaged during the Alaska field season to conduct investigations looking to the maximum beneficial use of the land and its resources.

Special studies were completed on the possibilities for settlement by groups of individuals in Alaska and new regulations authorizing such settlement were approved by the Secretary of the Interior.

A report on a study of the areas in Alaska best suited for agricultural settlement was prepared for public distribution and a comprehensive cadastral survey program which included the measurement of more than 12,000 acres in 12 separate tracts for lease or sale under the Federal Small Tract Act was set under way.

Coordination of the many activities of the Bureau in Alaska was centered in the Regional Administrator at Anchorage.

Foremost among the Bureau's achievements was the preparation of official public land orders which, becoming effective shortly after the close of the 1947 fiscal year, opened large areas of land in Alaska to settlement by veterans of World War II. One of these lifted the restrictions formerly placed upon lands adjacent to the Alaska Highway and made available approximately 2,750,000 acres of public land available for settlement under the public land laws. Another opened approximately 45,000 acres of public land in the Matanuska Valley to homesteading.

Special informational material was made available for public distribution in connection with these new Alaska land settlement opportunities, in response to requests whose volume averaged at least 5,000 per month.

RANGE MANAGEMENT

Range and livestock management operations in grazing districts during the 1947 fiscal year were seriously restricted by appropriation limitations. Although the issuance of licenses and permits for the livestock actually on the range was kept on a current basis, only limited trespass control and grazing supervision of the areas were possible.

Without contributions of approximately $200,000 from the advisory boards to maintain the essential grazing district organization, there would have been an even more severe curtailment in the management of the Federal range. In addition to the monetary contributions for administration purposes, the advisory boards and individual livestock operators gave material assistance in the installation and maintainance of range improvements.

The lack of adequate range use supervision resulted in widespread concern. In problem areas, there was a review of the records, some inspection of range units, and adjustments in numbers, seasons, and distribution for better range management. Some additional range line agreements were obtained to divide community allotments into individual allotments. An outstanding example of improvement management achieved even under the limitation on available funds was the extension of an agreement between the district grazier and the stockmen using the East Paradox cattle allotment in Colorado district No. 4. In this agreement, the season of use was reduced nearly 50 percent until such time as the forage conditions will withstand a longer period of grazing. Successful conservation and rehabilitation of the range depend upon this kind of cooperation for increased production of forage vegetation.

The real-estate market was active during the year and many sales and other property transfers presented a continuous series of changes under section 7 of the Federal Range Code. However, insufficient funds cause delays in bringing the property records in connection with such transfers by sale or otherwise up to date.

Grazing Fees

In July 1946 the Secretary requested Mr. Rex L. Nicholson, of California, to study and report on the administration of public lands for grazing purposes under the Bureau of Land Management as established by Reorganization Plan No. 3 of 1946. This report, dated November 9, 1946, included various recommendations, one of which dealt with grazing fees. Grazing fees were increased by secretarial order to 8 cents an animal unit month, effective May 1, 1947. Subsequently the Taylor Grazing Act was amended by Public Law No. 376 to provide for a separate grazing fee and range improvement fee. The Department established these fees at 6 cents and 2 cents, respectively, effective August 6, 1947, the date on which Public Law No. 376 was approved.

Range Conditions

The grazing districts in the Northern States for the most part had the advantage of approximately normal rainfall, and the end of the fiscal year witnessed very favorable range conditions, resulting from heavy snows and late spring rains in these States. A drought covered most of the range areas in Arizona and New Mexico, reported as extremely severe in the southern and moderate in the northern parts of the States. This drought condition extended into the southern edge of Utah and Colorado. There were other smaller, localized areas with less than normal moisture. A dry spring season in eastern Oregon resulted in very low surface water supply. A similar condition prevailed in western Nevada, where a resulting shortage in irrigation water is expected to force a reduction in hay crops for next winter's use.

Livestock Production

In general there has been a continued reduction in the numbers of sheep on the grazing district ranges. This reduction has been attributed principally to the currently favorable market, the scarcity of reliable labor, and predator losses.

The over-all numbers of cattle declined during the year as the operators took advantage of the market to cull their herds and to reduce the numbers formerly permitted on a temporary basis for increased meat production during the war. Drought conditions in certain areas also had an influence in the over-all reduction. In general calf and lamb crops were above average in weight and quality. Good wool crops also were reported.

A total of 8,784,327 livestock was authorized on the Federal range by licenses or permits during the year. This is a net reduction of 49,632 cattle, 11,041 horses, 539,201 sheep, and 13,555 goats, as compared to the 1946 fiscal year. Permitted use dropped approximately 1.7 percent from 15,254,398 to 14,993,597 animal unit months. The number of licensed operators decreased from 21,329 to 20,960, resulting principally from consolidation by sales and transfers.

Following is a statistical table showing permitted livestock on the range in Federal grazing districts:

Summary of permitted and licensed livestock by classes during the 1947 fiscal year

Regions	Number of cattle	Number of horses	Number of sheep	Number of goats	Total livestock
Region I:					
Oregon	239, 223	10, 556	213, 730		463, 509
Idaho	232, 955	14, 160	916, 922	15	1, 164, 052
Region II:					
California	98, 354	3, 416	148, 633	605	251, 008
Nevada	307, 256	11, 596	543, 924	311	863, 087
Region III:					
Montana	327, 975	20, 557	801, 983	30	1, 150, 545
Wyoming	166, 299	9, 527	1, 173, 301		1, 349, 127
Region IV:					
Utah	188, 433	5, 769	1, 413, 553	5, 052	1, 612, 807
Colorado	180, 836	6, 669	720, 587	135	908, 227
Region V:					
New Mexico	270, 924	13, 661	557, 615	34, 513	876, 713
Arizona	82, 885	1, 916	55, 895	4, 556	145, 252
Total	2, 095, 140	97, 827	6, 546, 143	45, 217	8, 784, 327

Grazing fees collected by States during the 1947 fiscal year

Regions	Federal range	Other lands	Total
Region I:			
Oregon	$68, 259. 11	$3, 119. 20	$71, 378. 31
Idaho	82, 202. 33	2, 175. 48	84, 377. 81
Region II:			
California	17, 395. 69	1, 843. 05	19, 238. 74
Nevada	145, 620. 69	1, 380. 93	147, 001. 62
Region III:			
Montana	60, 826. 81	57, 055. 47	117, 882. 28
Wyoming	96, 419. 28	3, 341. 36	99, 760. 64
Region IV:			
Utah	128, 308. 91	3, 210. 27	131, 519. 18
Colorado	54, 003. 52	709. 20	54, 712. 72
Region V:			
New Mexico	125, 207. 01	845. 63	126, 051. 64
Arizona	41, 205. 36	847. 05	42, 052. 41
Total	819, 448. 71	74, 526. 64	893, 975. 35

Wildlife

Estimates of the game animal population within grazing districts indicate an increase from 569,286 to 600,835 since 1946.

Estimated wildlife game population as of June 30, 1947

Whitetail deer	3,872
Mule deer	473,344
Elk	15,405
Antelope	102,927
Moose	410
Rocky Mountain Bighorn	[1] 2,918
Desert bighorn	450
Mountain goats	400
Javelina	710
Black bear	140
Buffalo	259
Total	600,835

[1] Includes 907 mountain sheep reported in Arizona and New Mexico.

Range Improvement Projects

Satisfactory upkeep of improvements already installed rather than an expansive program for construction of new range betterments was the major objective of the Bureau during the 1947 fiscal year, in view of the limited appropriations for this type of work. As much time as possible was devoted by personnel available for the maintenance operations. At the same time, some new activities were made possible by funds derived from stockmen's contributions and amounts "earmarked" by law for range improvement work. The achievements under this program since its inception more than a decade ago are shown in the following table:

Range-improvement projects within grazing districts, 1935–47

Type of project and unit of measurement	Completed fiscal year 1947	Completed or acquired, Apr. 1, 1935–June 30, 1947
Spring developments, number	28.0	2,145.
Reservoirs,[1] number	357.0	4,200.
Wells,[1] number	68.0	945.
Pipe and tile lines, miles	1.6	71.
Ditches, miles		58.
Truck trails,[2] miles	145.0	10,929.
Stock trails, miles	5.0	1,710.
Stock driveways, miles		1,486.
Bridges, livestock,[3] number		69.
Bridges, vehilcle,[3] number	1.0	114.
Fences, miles	542.0	8,005.
Corrals and holding traps, number	9.0	473.
Cattle guards, number	13.0	783.
Dipping vats, number		8.
Telephone lines, miles		380.
Firebreaks, miles		4,571.
Boundary marking, miles	63.0	4,877.

[1] Stock water. [2] Includes mine-access roads. [3] Over 20-foot span.

Field Activities

The limitations placed by lack of funds upon personnel in grazing districts resulted in some operators willfully grazing excess numbers of livestock and grazing in areas not covered by appropriate license or permit. This was done in defiance of regulations, knowing that supervision was curtailed. So far as possible, particular attention was directed to controlling this type of willful trespass and stopping it.

In an area in North Rosebud County, Mont., grazing district No. 2, an agreement was worked out with the range users whereby private landowners were granted exchange of use licenses. Participants in the agreements assessed themselves a fee on the basis of the acreage of private land owned to obtain funds to control trespass on the range area involved. The funds were contributed under section 9 of the Taylor Grazing Act for the employment of a grazier to supervise the range use of the area—approximately 220,000 acres.

Some attention was given to continuing the removal of excess horses from the range through cooperation with local stockmen, particularly in areas where the excess horse population still is a management problem.

Range surveys and dependent property surveys were limited to protest and appeal cases where basic resource data were essential to the apportionment of grazing privileges. Surveys to obtain additional basic data and to advance preliminary estimates of range and base property production were impossible of accomplishment with the limited field staff. Several range examiners were temporarily detailed to the Department of Justice for necessary survey work in western Colorado in connection with the Ute Indian claims suit. This work involved the making of new range surveys and the checking of old range surveys on 4½ million acres of Federal public land. The information obtained in this work will be made available to the Bureau of Land Management for use in range management work as soon as it is no longer needed in connection with court action.

At the Squaw Butte-Harney Range Experiment Station in Oregon, operated in cooperation with the Oregon State Agricultural College, the research program has been reviewed for an analysis, planning, and assembly of data for possible publication.

Close cooperation with the University of Wyoming is continuing in connection with the Church Buttes and Hadsell experimental projects. In the Church Buttes project records of dual use of range by sheep and cattle are being built up that will lead to definite findings for future use in obtaining the greatest possible returns from grazing lands consistent with conservation practices. The Hadsell experiment is endeavoring to determine the effect supplemental feeding of minerals to sheep has on the sheep's teeth, and also to determine the possibility of regulating the degrees of utilization of certain overgrazed plant species by supplemental feeding of minerals apparently sought for in the overgrazed plants.

Cooperation is continuing with the University of Montana on a grass-clipping study in Montana grazing district No. 5. Measurement of volume production on several dominant grass species is correlated with height, growth, and density factors. This study has been in progress for a number of years.

In connection with a cooperative wildlife and research project in Utah, designed primarily to study the problem of competition between range livestock and wildlife, lists were prepared of permittees and grazing privileges, by allotments, so that the relation of forage, wildlife, and authorized livestock can be studied for any particular game unit. A special appropriation for this State-wide project was received by the Fish and Wildlife and Forest Services. The Bureau of Land Management is an interested cooperating agency.

Soil and Moisture Program

The soil and moisture conservation program in grazing districts was carried on within the limitation of personnel and operating restrictions.

Grazing Districts

As of June 30, 1947, the Bureau administered under section 3 of the Taylor Grazing Act on the grazing on 142,140,308 acres of grazing-district lands in 10 Western States as shown by the following table.

Area, in acres, of grazing-district lands, June 30, 1947

State	Number of districts	Vacant public lands [1]	Other lands	Total
Arizona	4	8, 847, 323	2, 569, 152	11, 416, 475
California	2	2, 903, 553	8, 667	2, 912, 220
Colorado	8	7, 554, 496	388, 492	7, 942, 988
Idaho	5	12, 116, 733	266, 802	12, 383, 535
Montana	6	5, 234, 656	1, 785, 781	7, 020, 437
Nevada	5	32, 144, 367	60, 186	32, 204, 553
New Mexico	7	14, 228, 054	2, 094, 499	16, 322, 553
Oregon	7	12, 303, 717	510, 875	12, 814, 592
Utah	11	23, 532, 767	853, 779	24, 386, 546
Wyoming	5	13, 502, 735	1, 233, 674	14, 736, 409
Total	60	132, 368, 401	[2] 9, 771, 907	142, 140, 308

[1] Includes lands covered by rights-of-way, mining claims not of Federal record, and mineral withdrawals for classification.

[2] Includes 8,552,175 acres in withdrawals administered under agreement with other Federal agencies, 851,603 acres of private lands administered under cooperative agreements, and 368,129 acres of non-Federal lands leased under the Pierce Act.

In addition, a total of 11,549,165 acres were made available for grazing under 10,089 leases issued in accordance with provisions of section 15 of the Taylor Grazing Act.

SURPLUS REAL PROPERTY

The Bureau continued to serve as official agent during the 1947 fiscal year for the War Assets Administration in the disposal of Government property declared to be surplus upon the expiration of its value for military use. Under this program, the Surplus Real Property Division received a total of seven declarations of surplus real property and miscellaneous acquisitions valued at $1,877,227 located within the continental limits of the United States and 23 declarations valued at $12,101,276 located in the Territories and island possessions.

Some of the highlights of the disposal activities of the Bureau during the year were the sale of Chilkoot Barracks, in Alaska, to a veteran of World War II and the liquidation of properties used as War Relocation Centers in Arkansas, Arizona, California, Idaho, and Wyoming.

Auxiliary airfields at Mayaguez, Arecibo, and Santa Isobel, in Puerto Rico, also were included in the disposal program of the Bureau during the year.

THE PUBLIC LANDS

Area of the Public Lands

The area of public lands remaining in Federal ownership, including Indian trust and tribal lands, as of June 30, 1947, amounted to about 413 million acres in the public-land States and about 365 million acres in Alaska. Approximately 434 million acres of these public lands were vacant, unappropriated, and unreserved as follows: 37 million acres in the States outside of Federal grazing districts; 132 million acres within such districts; and 265 million acres in Alaska. During the year 729,000 acres were withdrawn for various public purposes while withdrawals reserving 20,235,000 acres were revoked.

Of the approximately 778 million acres remaining in Federal ownership in the States and Alaska, 117 million acres in the States and 363 million acres in Alaska were still unsurveyed as of June 30, 1947.

The total acreage patented with minerals reserved to the United States was increased during the year to 49,146,942 acres as shown on the following table:

Acreage of lands patented with minerals reserved to the United States, as of June 30, 1947

Type of mineral reservation	Patented during fiscal year 1947	Total patented through June 1947
	Acres	*Acres*
Reservation of all minerals:		
Under Stock Raising Act	2,888	33,599,714
Under other acts	[1] 48,796	[1] 2,501,956
Total all minerals	51,684	36,101,670
Reservation of specific minerals:		
Coal	[2] 42,400	[2] 10,920,452
Fissionable materials	26,999	26,999
Others [3]	[4] 162,732	[4] 2,097,821
Total specific minerals	232,131	13,045,272
Grand total	283,815	49,146,942

[1] Includes reservation of fissionable materials in 24,378 acres.
[2] Includes reservation of fissionable materials in 41,483 acres.
[3] Includes coal reserved in combination with other minerals.
[4] Includes reservation of fissionable materials in 156,623 acres.

Leases and Permits

During the year the area under lease, including mineral permits and licenses, increased by 2,362,714 acres, making a total of 22,030,697 acres under lease at the end of the year. The types of leases in force June 30, 1947, are shown by the following tables.

Mineral leases, permits, and licenses outstanding, as of June 30, 1947

Mineral	Leases		Permits		Licenses		Total	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Public lands:								
Oil and gas	[1] 10,898	8,071,259					10,898	8,071,259
Coal	336	79,978	68	70,256	61	2,355	465	152,589
Sodium	3	1,240	38	63,634			41	64,874
Phosphate	11	5,391					11	5,391
Potash	23	52,775	8	19,711			31	72,486
Silica sands	2	400					2	400
Vanadium	2	189,440					2	189,440
Total public lands	11,275	8,400,483	114	153,601	61	2,355	11,450	8,556,439
Acquired lands:								
Oil and gas	193	233,452					193	233,452
Various minerals			92	33,373			92	33,373
Total acquired lands	193	233,452	92	33,373			285	266,825
Grand total	11,468	8,633,935	206	186,974	61	2,355	11,735	8,823,264

[1] Does not include 21 leases (9,566 acres) within naval reserves.

Leases other than mineral leases outstanding, as of June 30, 1947

Type of lease	Number	Acres	Annual rental
Aviation	49	31,387.68	$576.00
Fur farm (Alaska)	19	133,810.00	775.00
Grazing (Alaska)	8	1,168,316.00	1,175.00
Grazing (Oregon and California)	239	276,045.17	18,128.29
Grazing (Taylor Act, sec. 15)	10,089	11,549,164.99	233,480.01
Recreational	17	20,058.56	[1] 615.70
Small tract	5,626	27,857.81	[2] 27,998.06
Water well	16	640.00	635.50
Others	3	153.01	10.00
Total	16,066	13,207,433.22	283,393.56

[1] Does not include rental of 1 lease, the rental of which is based on receipts.
[2] Does not include rental of 35 business site leases, the rentals of which are based on receipts.

Homesteads, Sales, and Other Entries

The following table shows the new entries and selections allowed, the entries finally approved and the patents and certifications issued during the year. At the end of the year, 3,996 entries embracing 599,000 acres were pending awaiting further compliance with the public land laws by entrymen or final action by the Bureau.

Original entries and selections allowed, final entries approved, and patents and certifications issued, fiscal year 1947, by type of entry or selection

Type of entry or selection	Original entries and selections [1]		Final entries [1]		Patents and certifications [1]	
	Number	Acres	Number	Acres	Number	Acres
Homestead entries:						
Stockraising	1	635.43	9	5,553.11	6	2,888.10
Enlarged	------	----------	[2] 4	626.84	3	917.57
Reclamation	183	19,949.19	[3] 134	14,608.70	245	27,963.29
Forest	6	228.15	------	----------	2	320.00
Commuted	------	----------	[4] 26	2,121.99	2	320.00
Section 2289, Revised Statutes et al	[5] 285	34,278.98	[6] 70	7,289.34	37	3,751.96
Total homestead entries	475	55,091.75	243	30,199.98	295	36,160.92
Other entries and selections:						
Desert-land entries	26	3,184.01	24	3,170.72	14	1,247.48
Public auction sales	------	----------	75	7,618.47	99	10,124.14
Timber and stone entries	1	40.00	4	199.95	3	160.00
Mineral entries	64	5,809.47	57	4,768.67	22	2,691.16
Indian selections	------	----------	3	371.52	202	16.09
Miscellaneous cash-sale entries	9	(7)	[8] 247	6,160.09	384	10,766.41
Exchanges	------	----------	------	----------	165	341,055.25
State selections	28	12,008.21	------	----------	2	[9] 466.01
Curative and supplemental patents	------	----------	------	----------	110	(10)
Other	------	----------	4	82.05	67	541.09
Total other entries and selections	128	21,041.69	414	22,371.47	1,068	367,067.63
Grand total	603	76,133.44	657	52,571.45	1,363	403,228.55

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[1] An original entry or selection is one made in pursuance of an act of the Congress which prescribes the terms and conditions under which patent may be issued or other evidence of title granted. An original entry becomes a final entry upon compliance by the entryman with further requirements of the law, such as residence or additional payment, and upon the issuance of a final certificate. A final certificate shows that, in the absence of irregularity, the entryman is entitled to a patent and passes equitable title to the land to the entryman. Where upon final examination it is found that an entry or selection is in proper form and that the law has been complied with, a patent conveying legal title to the claimant is issued. In the case of certain State selections, the legal title is conveyed upon approval thereof by the Secretary of the Interior and upon certification by the Director of the Bureau of Land Management.

[2] Includes 1 homestead on ceded Indian lands (80.00 acres).

[3] Includes 14 homesteads on ceded Indian lands (1,449.27 acres).

[4] Includes 21 homesteads on ceded Indian lands (1,681.99 acres).

[5] Includes 1 homestead on ceded Indian lands (39.81 acres).

[6] Includes 8 homesteads on ceded Indian lands (561.27 acres).

[7] Town lots upon which only part payment was made (area not tabulated).

[8] Includes 45 ceded Indian town lots (area not tabulated).

[9] Includes certifications, 331.24 acres.

[10] Acreage previously reported.

In addition, 395,000 acres were being used at the end of the year by Federal and local agencies, private individuals, and corporations under permit from the Bureau.

Land Grants

Title to 466 acres was conveyed during the year in satisfaction of grants of public lands made by the Congress to States for public purposes, including 331 acres of indemnity school land selections and 135 acres of swamp land.

A total of 373 applications for rights-of-way were approved during the year under laws which provide for the granting of rights-of-way over the public lands for telephone and telegraph lines, public roads, pipe-lines, and other purposes. Of the applications approved, 57 were permits or easements with an annual rental of $1,471 and 53 were temporary rights-of-way over "O and C" lands with an annual rental of $745.

Land Exchanges

Exchanges of land with private owners and local governments resulted in the addition of 175,751 acres to grazing districts in exchange for 158,026 acres of Federal land; 9,416 acres to Indian reservations in exchange for 11,455 acres; 16,242 acres to the "O and C" lands in exchange for 5,900 acres; 40 acres to a national wildlife refuge in exchange for an equal acreage; and 404,732 acres to national forests in exchange for 165,634 acres of land and sufficient timber to equalize the values involved.

Receipts and Expenditures

Receipts from all sources during the year totaled $21,012,154.34. Mineral rentals, royalties, and bonuses accounted for 77 percent of the total receipts and sales of timber from the Oregon and California and Coos Bay lands for an additional 14 percent. Grazing activities under the Taylor Grazing Act yielded 5 percent while the remaining 4 percent were realized from sales of public and ceded Indian lands, rentals, fines and penalties, copying fees, sales of surplus real property and from miscellaneous sources.

Of the total receipts, 38 percent will be distributed among various State and county governments and 41 percent will be covered into reclamation funds. Of the remainder, $18,102.71 will be credited to Indian trust funds, $258,640.27 will be credited to the range improvement funds, and $59,311.17 will be transferred to the Department of Agriculture.

Expenditures from appropriations amounted to $4,398,804 distributed as follows: general administration, $1,863,028; surveys $569,179; field examination, $442,980; fire protection and timber management, $541.695; administration of the revested and reconveyed grant lands, $397,264; district land offices, $312,706; range improvements, $229,022; surveys and investigations in Alaska, $36,700; and leasing of grazing lands, $6,230. Expenditures, aggregating $1,889,226, were made from funds transferred to the Bureau for: Disposal of surplus real property, $588,046; Missouri River Basin project, $364,829; soil and moisture conservation operations, $686,808; white pine blister rust control, $133,423; Naval ordnance test station, $43,262; access roads, $47,073; reclamation projects, $16,784; military camp, $5,980; and legal research, $3,021.

The following table shows the receipts earned during the year, by sources and Treasury accounts.

Distribution of receipts of the Bureau of Land Management,[1] fiscal year 1947

Source of receipts	Covered into the Treasury earmarked for—				
	Indian Trust funds	Reclamation funds	States and Counties	Other funds	Total
Mineral leases and permits:					
Mineral Leasing Act		$7,938,913.85	$5,670,652.76	$1,512,174.05	$15,121,740.66
Red River oil and gas lands	$6,465.41		3,879.24		10,344.65
Potash		[2] 512,266.42	313,938.40	83,716.89	909,921.71
Other				[3] 224,200.01	224,200.01
Total mineral	6,465.41	8,451,180.27	5,988,470.40	1,820,090.95	16,266,207.03
Sales of public lands		87,196.21	6,460.54	54,752.42	148,409.17
Fees and commissions		67,636.37		3,725.71	71,362.08
Oregon and California grant lands			1,444,865.38	1,444,865.38	2,889,730.76
Coos Bay grant lands			25,000.00	123,980.55	148,980.55
Taylor Act grazing leases	6,175.65		107,556.18	[4] 107,556.18	221,288.01
Taylor Act grazing-district fees	83.47	5,195.56	409,682.62	[5] 474,646.09	889,607.74
Sales of surplus real property				235,571.00	235,571.00
Rights-of-way		1,459.90		27,621.11	29,081.01
Sales of Reclamation lands		3,113.14			3,113.14
Sales of Indian lands	5,378.18				5,378.18
Copying fees				26,196.27	26,196.27
Other				77,229.40	77,229.40
Grand total	18,102.71	8,615,781.45	7,982,035.12	4,396,235.06	21,012,154.34

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[1] Before final settlement of all accounts by the General Accounting Office.

[2] Includes $72,752.67 collected in California under act of Oct. 2, 1917 (40 Stat. 297).

[3] Includes $29,490.07 collected in Wyoming under act of June 26, 1926 (44 Stat. 1621), $167,237.37 collected in California under Executive Order 9087, dated Mar. 5, 1942, $25,527.89 collected in Alaska, $538.61 collected in Nevada, and $1,406.07 collected in Louisiana under Executive Order 9632, dated Sept. 28, 1945.

[4] Includes $53,778.09 for the range improvement fund (outside of grazing districts).

[5] Includes $204,862.18 for the range improvement fund (grazing districts) and $59,311.17 for the Department of Agriculture.

Fish and Wildlife Service

ALBERT M. DAY, DIRECTOR

EVENTS both at home and abroad combined to make the year 1947 one that made unusually heavy demands upon our wildlife resources, whether used for recreational or commercial purposes. The increase in the number of hunters and fishermen, which began even before the close of the war, has continued at such a rate that at the close of the year the total number of such sportsmen exceeded all previous records. To meet the demands of the more than 20 million Americans who depend upon wildlife for their principal recreation, we must maintain the populations of fish, waterfowl, and large and small game at a high level. On the other hand, the forces which destroy wildlife habitat and make it increasingly difficult for wild creatures to survive, become each year stronger and more far-reaching in their effects.

As for the resources utilized commercially, the critical world food situation continued to emphasize the necessity of exploring fully the potential productiveness of our fisheries, and of developing neglected resources.

The Fish and Wildlife Service, through basic research and direct management of certain resources, continued its efforts to bring about the maximum development of the biological resources that can be achieved under the conditions of the modern world.

THE STATUS OF MIGRATORY GAME BIRDS

Waterfowl management investigations of 1947 have shown the condition of our waterfowl resource to be serious. The continental population which began declining in 1945 has continued its downward trend at an alarming pace. In January 1947, the annual inventory of the birds wintering in Canada, Alaska, coastal Latin America, and the United States showed the trend to have reached a figure of 54,000,000, a decrease of 26,000,000 from the 1946 estimated population.

Decreases in wintering ducks and geese were recorded for all flyways except the central flyway. While not all species showed decreases over the previous year, none of the populations were considered satisfactory. Among the ducks showing increases were the pintail, shoveller, green-winged teal, and ringneck. Mallards, widgeons, black ducks, blue-winged teal, wood ducks, and ruddies decreased. All of the geese with the exception of the blue and white-fronted species also decreased during the year. Trumpeter swan populations remained about the same, but a marked increase was recorded for the whistling swan.

Studies of the year brought out the distribution of waterfowl, hunters, and kill of ducks in the several flyways. These data are summarized in percentages, by flyways, as follows:

	Atlantic flyway	Central flyway	Mississippi flyway	Pacific flyway
Waterfowl	15	33	25	27
Hunters	14	25	42	19
Kill	9	29	37	25

Intensive studies of Canadian breeding grounds during the spring of 1947 added more evidence of the seriousness of the waterfowl situation. While the investigations brought to light marked increases over 1946 in breeding ducks in southern Alberta and southern Saskatchewan, the populations there were still not comparable to earlier years and not sufficient to offset the declines in other parts of the Prairie Provinces. Quantitative data showed the core of production in 1947 to be in the southern semiarid prairies, with breeding ducks becoming less numerous to the north and east. The breeding grounds in general had satisfactory spring water levels but in most sections showed the results of the several drought years. Drought this summer was most damaging in the northwestern part of Saskatchewan. Floods damaged many large marsh and lake areas especially in Manitoba. Burning and plowing of stubble in Saskatchewan were potent limiting influences this year.

The status of woodcock is satisfactory. Reports from practically all check areas indicate a normal or slightly increased population. Both band-tailed pigeons and white-winged doves appear to be holding their own except in a few local areas.

Knowledge of the distribution, migration, and abundance of North American migratory birds protected under the treaties with Great Britain and Mexico, was advanced along several lines. These were: (1) Exploration of remote breeding grounds in the Arctic; (2) the plotting of breeding and wintering grounds from accumulated information obtained through two programs—(*a*) birdbanding, and (*b*) migration reports; (3) exact quantitative studies of abundance of birds in definite areas in relation to environment.

Two biologists made a reconnaissance of several of the remote Canadian-Arctic islands in cooperation with the United States Navy. Some of the northernmost breeding grounds of our migratory birds, including eiders, scoters, old-squaw ducks, brant, several sandpipers, Lapland longspurs, snow buntings, and horned larks, which visit the United States during the winter, were explored. Other biologists carried on exploratory studies in Newfoundland and in the southeastern United States.

Making use of accumulated data on distribution and migration, the breeding and winter ranges of the loons, grebes, petrels and their allies, cormorants, pelicans, herons, and shorebirds, were revised to bring our working knowledge of these birds up-to-date.

RESEARCH IN WILDLIFE MANAGEMENT

The scarcity of men trained in the technique of wildlife management has become especially serious as the increase in the number of hunters and fishermen requires larger populations of game to maintain recreation.

Nine cooperative wildlife research units, financed by State game departments, land-grant colleges, the Wildlife Management Institute, and the Fish and Wildlife Service, operated research and training programs at full capacity during the year. These were in Iowa, Maine, Missouri, Ohio, Oregon, Pennsylvania, Texas, Utah, and Virginia. A tenth unit, Alabama, remained inactive due to shortage of personnel.

Research projects numbered about 90, and covered the wide fields of farm and forest game, fur animals, habitat restoration, and many aspects of practical game management. About 40 trained men, including 6 receiving the doctorate and 11 the master's degree were graduated. Most of these men began some type of professional work in the wildlife field immediately after the completion of their training.

At the wildlife research laboratories at Patuxent, Md., and Denver, Colo., a variety of studies were actively carried forward. At Patuxent, these included second-year observations of areas sprayed with DDT and studies of the nutritive requirements of quail.

Approximately 1,400 compounds have been tested in attempting to find new rodenticides having minimum toxic effect on humans and domestic animals. Two compounds are promising enough to warrant further study. A drop of one of these, tetraethyl pyrophosphate, is capable of killing 100 large rats and it is easily hydrolyzed to nontoxic products. This means that exposed baits would soon become innocuous and there would be no chance of secondary poisoning.

Working with the Soil Conservation Service, University of Maryland, and Wildlife Management Institute, two experimental farms are being developed in Maryland to test agricultural soil conservation practices as aids to farm wildlife production. A companion project is under way in Alabama where wildlife inventories will be made on lands under conservation plans and those without.

Special studies are being made to determine the most effective means of producing plants useful to waterfowl and muskrats in turbid, stained, and acid water impoundments. Research on the control of undesirable plants has shown that worthless marshes can be converted into productive waterfowl feeding grounds in 1 year. Regional control studies with a number of the most harmful plants have shown that chemical herbicides have promise when properly used.

As a result of the great postwar interest in supersonics, experiments were run at the Denver laboratory on eight different animals to determine their response to sound waves of 24-kilocycle frequency. Mice were the only animals tested which reacted at all and these were not strongly affected.

Fur consumption in the United States continues to increase. To meet this demand trappers still take fur animals extravagantly disregarding the maintenance of a satisfactory breeding stock. Surveys by the Fish and Wildlife Service show that this lively demand for furs encourages trappers to take in excess of 28,000,000 pieces annually, for which they receive $100,000,000 to $125,000,000. The total trapping population of the United States and Alaska is about 2,700,000, three-fourths of which are farmers and farm boys.

More fur apparel is manufactured and sold at retail in the United States than in any other country in the world. Last year (1946) the retail turn-over in furs exceeded $495,000,000. Twice as many foreign as domestic furs are now being used in this country, and the demand is increasing.

The Service carries on research to insure a continuing supply of wild fur, to help protect, restore, and replenish this important natural resource. In order to protect and maintain a sustained yield of wild fur animals, it is necessary to improve laws and law enforcement, restock depleted areas, and develop new habitats for fur animals.

LAND FOR WILDLIFE

During the last 5 years, major emphasis in the national wildlife-refuge program has been on acquisition of wintering refuges along both coasts and especially in areas near the Gulf of Mexico. Eleven new refuges, comprising about 192,000 acres, have been acquired for this purpose. These are located in California, Texas, Oklahoma, Missouri, Tennessee, Kentucky, South Carolina, and Florida.

The Laguna Atascosa National Wildlife Refuge, near Brownsville in southern Texas, is one of the newest wintering areas. It will prove important in safeguarding wintering mallards, canvas-backs, and pintails in the important Laguna Madre concentration area. One flock of redheads seen from the air during February 1947 contained an estimated 100,000 birds.

The Hagerman and Tishomingo National Wildlife Refuges on Lake Texoma, an impoundment created when the Denison Dam was constructed across the Red River near Denison, Tex., by the United States Corps of Engineers, have demonstrated the success of this type of development. Waterfowl use on this portion of the Red River prior to construction of this impoundment in 1944 was negligible, but in the fall of 1946 from 20,000 to 30,000 mallards, pintails, and green-winged teal made full use of these areas. In the spring of 1947 at least 8,500 geese visited the area.

On the Mingo National Wildlife Refuge in southeastern Missouri, wintering mallards feed on acorns, wild millet, smartweed, and chufa. When acquisition is complete and water developments have been constructed, the area of natural food will be greatly increased. It is expected that this refuge will attract a part of the Canada goose flight down the Mississippi River Valley.

During the war, and even at the present time, development of newly acquired refuges has been difficult. The shortage of materials, increased construction costs, particularly where heavy equipment is required for earth moving, and limited funds have permitted little new development.

Completion of the program to provide even the minimum areas needed to retain our wildlife is proceeding slowly against many difficulties. With continuing, and even increasing, activities in drainage, oil exploitation, construction of harbor installations, inland waterways, and industrial sites, the competition for remaining marshes or marsh restorations is forcing the purchase prices out of reason. It is evident that rounding out the national wildlife refuge program will require greater use of flood control, irrigation, hydroelectric, reservoir, and navigation pools on each of the major watersheds in the United States. Natural areas for restoration and development in sufficient size, and at reasonable cost, are no longer available at the critical waterfowl concentration points throughout the country.

Approximately 24,300 acres of refuge lands were cultivated by private individuals and by refuge personnel in 1946, producing 827,800 bushels of grain and other crops of which about 265,666 bushels were utilized as food for wildlife. Approximately 853,200 acres of grasslands were utilized during the year for 296,062 animal-use months of grazing, while 15,727 tons of hay were harvested on 27,200 acres of meadowlands.

The selective removal of timber allows for the growth of other species of greater value to wildlife. During 1946, 9,015,200 board feet of timber were cut and removed, or approximately double the production of the previous years.

More than 2,100 individuals participated, under special use permit, in the economic use program on national wildlife refuges, exclusive of the number purchasing surplus big-game animals and those who trapped fur animals on refuges. A total net revenue of $545,336.80 for this fiscal year resulted from all economic uses, including the disposition of big-game animals, fur-animal pelts, and surplus products. By law, 25 percent of this revenue was paid to the counties in which the national wildlife refuges are situated, and the balance was deposited in the Treasury of the United States.

Public use of refuges for fishing, boating, picnicking, as well as for photographing and observing wildlife, was greater than ever before. In both 1945 and 1946 on the Bear River Migratory Bird Refuge, Utah, more than 10,000 persons toured the 14 miles of dikes or hunted in the public shooting area. On the Okefenokee National Wildlife Refuge, Ga., more than 5,600 persons used the refuge in 1946 for fishing, while on the Wichita Mountains Wildlife Refuge, Okla., approximately 250,000 visitors enjoyed the famous Easter pageant as well as the varied recreational opportunities.

In 1946, 288,919 man-days of recreational fishing on the refuges resulted in a take of 2,064,892 fishes, an increase of almost 75 percent in use and 167 percent in the success of such fishing. During the same period, 2,493,817 fish were stocked in refuge waters. An estimated 1,298,209 pounds of rough fish were taken in commercial fishing; nearly 45 percent more than in 1945. On the Wheeler National Wildlife Refuge, Ala., shell fishermen took 660 tons of mussel shells, valued at $25,813, a revival of a formerly important industry in waters of the Tennessee River.

The trumpeter swan, America's rarest waterfowl, increased its United States population during the past year by 60 birds to reach a new total of 361 for the flock. Of this number, 170 were found on the Red Rock Lakes Refuge, Mont., and 46 of the cygnets were hatched on the refuge.

Twenty-five of the twenty-nine whooping cranes—all that remain of this endangered species—wintered on the Aransas National Wildlife Refuge, Tex. During the 10 years since this 47,000-acre refuge was acquired to protect these birds, their numbers have varied but little, indicating practically no production of young on their nesting grounds, believed to be in northern Alberta and Saskatchewan.

The number of national wildlife refuges at the end of the fiscal year 1947 was 291. During the year, the Michigan Islands National Wildlife Refuge was established by Public Land Order No. 365 on April 18, 1947; the three islands—Scarecrow, Shoe, and Pismire—comprise 11.94 acres. Administration of the former Apache National Wildlife Refuge was assumed by the Forest Service, United States Department of Agriculture, in accordance with the Executive order of January 29, 1947.

MANAGEMENT OF FISHERY RESOURCES—ALASKA'S AQUATIC WEALTH

In Alaska, the Fish and Wildlife Service exercises direct jurisdiction over the animal resources. To obtain the information needed for effective management, scientific studies of certain of these resources are in continuous progress.

The red salmon runs of western Alaska have declined in abundance in recent years despite the fact that at least 50 percent of each year's run has been allowed to ascend the rivers to spawn. At Karluk River, on Kodiak Island, the population which once furnished over 3 million salmon a year to the commercial fishery has declined since about 1900. Only twice in the past 26 years has the commercial catch exceeded 1 million fish. Analysis of the numbers of adult salmon that had been marked when they were seaward-migrating young, shows mortality at sea to have been fairly constant and not unduly high. This is in sharp contrast to the condition that has obtained during the fresh-water phase of the salmon's life, which, in recent years, has been marked by heavy mortality. The factors responsible for this must be intensively studied if the decline in the red salmon runs is to be halted.

The pink salmon which contribute the bulk of the salmon pack in southeastern Alaska vary widely in abundance from year to year. They spawn in thousands of small streams and the eggs are therefore subject to great and fluctuating losses in accordance with meteorological conditions. Immediately after emerging from the gravel in the spring the young go to sea where they again suffer a high loss, which, however, does not vary as widely as the stream losses. The Service field station at Little Port Walter has been observing annual survival rates of pink salmon in Sashin Creek, but because of the wide variety of climatic conditions in southeastern Alaska the results apply to only a fraction of the streams. Similar field stations are needed in other localities.

Biological research has paid large dividends for the Alaska herring fisheries. Annual sampling of the age composition and abundance of the chief races of herring exploited by the fishery has enabled the Service to set catch quotas in each district, which prevent depletion of the spawning stocks and stabilize the annual yield of the fishery. Consequently, abundance has been restored in the once depleted herring fisheries of southeastern Alaska.

The Pribilof Islands fur-seal herd, which comprises 80 percent of all the fur seals in the world, is managed by the Fish and Wildlife Service for the United States and Canada.

During the year ending June 30, 1947, a total of 64,523 fur-seal skins were taken on the Pribilof Islands. In the same period 1,040 fox pelts were taken, incidental to sealing activities. The byproducts plant, operated in connection with the fur-seal industry, produced approximately 31,225 gallons of fur-seal oil and 264 tons of meal, which were sold for the account of the Government for the total gross amount of $45,435.03.

The annual census of the fur-seal population, completed on August 10, 1946, showed that the herd contained 3,386,008 animals at that time, an increase of 7.31 percent over the 1945 census. In 1910, when the Government assumed direct control of the Alaska fur seals the herd numbered only 132,279 animals.

Equipped as a floating laboratory, the motorship *Black Douglas* left Seattle, Wash., on May 14 for north Pacific waters to make investigations of biological problems connected with the management of this resource. These studies will include the migratory routes, food, and mortality during the 9 months of each year spent at sea, as well as studies on the Pribilofs to improve census methods and increase the efficiency of management.

Revised regulations for the protection of the commercial fisheries of the Territory were issued by the Secretary of the Interior on March 22 for the 1946 season. Major changes in these regulations over the preceding year included an increase in the herring catch quota for the Kodiak area from 300,000 to 400,000 barrels, and an increase in the southeastern Alaska herring catch limit from 250,000 to 300,000 barrels.

The opening dates for salmon fishing in the northern districts of the southeastern Alaska area were from 5 to 10 days later than in 1945. In most districts of this area the weekly closed period was extended from 36 to 60 hours and several additional days were added at the end of the open season.

Fishery patrol facilities during the season of 1946 included nine sea-going patrol vessels, nine speedboats and numerous small craft, and six Government-owned airplanes which flew a total of 370 hours on fishery-patrol work. Eleven permanent agents supervised the fishery-management program, assisted by fishery biologists, wildlife agents, and seasonal personnel.

A total of 153 persons and concerns were apprehended for alleged violations of the Alaska fishery laws and regulations, resulting in fines totaling $17,005 and jail sentences aggregating 840 days, of which 750 days were suspended sentences. Proceeds from the sales of confiscated fish amounted to $5,363.39.

From time to time, throughout the season, surveys were made to determine the extent and condition of the salmon runs, and on the basis of this information the regulations were modified in a number of instances to permit larger escapements or to facilitate the utilization of salmon when they appeared in greater abundance than originally anticipated. Weirs for counting the escapements of spawning salmon and for obtaining biological data were maintained in six representative streams in the Territory.

SALMON CONSERVATION IN THE UNITED STATES

The effect on the salmon resources of the Columbia and Sacramento Rivers of construction of Federal dams and impoundments has been the subject of intensive study in cooperation with the Bureau of Reclamation and the United States Army Engineers. The runs of 1946 and 1947 have shown conclusively that the Service has been successful in its program for transplanting the salmon runs cut off from the 1,100 miles of spawning streams above Grand Coulee Dam to four tributaries entering the Columbia below the dam. A most difficult problem is to devise means for passing young salmon down over the dams on their seaward migration. Studies show that a fair percentage of young salmon are injured passing down over as low a dam as Bonneville, and continuing studies have not yet disclosed a practical method of diverting the young salmon into safe channels.

The activities of fish cultural stations on the west coast have been concentrated almost entirely upon the production of salmon in an effort to maintain the present run. Extensive studies are under way to determine more precisely the role that artificial propagation must play in the future maintenance of the salmon fisheries of the Columbia.

The salvage program to prevent damage to the Sacramento River salmon runs by the construction of Shasta Dam also has been a success. The low temperature of the water withdrawn from the lower levels of the reservoir has enabled the spring-run chinook salmon to remain unharmed in the river during the summer months until spawning time.

The Atlantic salmon is one of the most valuable species of fish on the North Atlantic coast. These fish have been experimentally reared to large fingerling size, then released after the clipping of certain fins for identification. This year, for the first time, marked fish that have gone to sea and returned to spawn are being taken by anglers. The feasibility of a stocking project is thus established. Changes and improvements in salmon feeding and rearing have been instituted in Federal hatcheries operated in the State of Maine, resulting in a more robust stock for planting.

MARINE FISHERY RESEARCH

The Service actively participates with several States in the program of rehabilitating shellfishery resources. Extensive field studies and experiments in the cultivation of oysters show that the decline in productivity of oyster bottoms can be stopped only by a well-planned system of their management. Restrictions imposed on the fishery, such as closed seasons, or limitation on catch and on the efficiency of gear, are not sufficient to restore the oyster populations of those bars, which through many years of neglect and overfishing have been exhausted. The oyster bars in the Potomac River are an excellent example of such a condition. These potentially highly productive grounds were exhausted to such a degree that restriction on dredging in the river, enforced by the State of Maryland, was entirely ineffective in restoring productivity. After completing a careful survey of the Potomac oyster bars, the Service recommended that the States of Maryland and Virginia establish an interstate authority for the management of Potomac fisheries. It is gratifying that this plan, suggested 2 years ago, is now being considered by both States, and plans are being perfected for an effective cooperation in conservation and control of the oyster resources of the Potomac.

In some Southern States, South Carolina and Texas, for example, the conservation of oyster resources can be accomplished simply by preventing the unnecessary destruction of seed oysters. Oysters in these waters grow in large clusters consisting primarily of young or undersized specimens which are discarded by the shuckers. For one adult oyster used by the shucker, several small ones are needlessly destroyed. Enforcement of cull law and salvaging of small oysters from the shucking pile and their return to water within 48 hours are recommended as necessary conservation measures.

In the New England States the Fish and Wildlife Service aids the oyster industry by issuing bulletins describing the conditions of the oyster bottoms, the presence of such oyster enemies as starfish and drills, and by predicting the time of spawning and setting of oysters.

The latter information, at present available only for Long Island Sound, is of particular importance to the oyster grower.

During January and February 1947 there was unprecedented mortality of fish and shellfish along the coast of Florida. Observations conducted by the Service jointly with the marine laboratory of the University of Miami and the Woods Hole Oceanographic Institution disclosed that mortality was due to the sudden propagation of a micro-organism of the group of dinoflagellates, *Gymnodinium* sp. The presence of countless millions of this form in the sea caused reddish discoloration of the water. The mortality of fish is due to toxic substances produced by *Gymnodinium*. The phenomenon, generally known as "red tide," has been previously recorded along the Pacific coast, in Narragansett Bay, in Japan and along the coast of Peru. In violence and duration the recent outbreak along the Florida coast far surpasses all previous occurrences recorded in scientific literature. The red water off the Florida coast contained a substance or substances, which, as tiny droplets, are transferred through the air and cause irritation to the respiratory tract in human beings. This resulted in serious discomfort to thousands of residents along the coast of Florida and led to the erroneous belief that the effect was produced by poisonous gases.

The shrimp population of the Gulf of Mexico was the object of tagging experiments during the spring of 1947. The purpose of this work was to test an hypothesis that shrimp migrate between Texas and Mexican waters. Since there is no established fishery on the upper Mexican coast, the shrimp were tagged so that if a northward migration occurred, the tagged individuals would be recovered in the Texas fishery. Such a movement would follow the pattern found to exist on the South Atlantic coast.

In all, 1,000 tagged individuals were released along the Mexican coast from a distance of about 10 miles below the Rio Grande to about 100 miles below the International border in the vicinity of Hut's Bayou. By the end of May, about 2 months after the tagging, returns had reached a total of 130, or 13 percent of the releases. These returns were scattered from below the border in Mexican waters to a distance of about 75 miles north of the border in Texas waters.

The marked decrease in landings of the Pacific pilchard, or sardine, was followed by a disastrous decline during 1945–46. This may be attributed to two factors. First, there have been, as a result of a succession of poor year-classes since 1940, less pilchards in the sea to be caught. Second, such fish as there are have not been available to the fishermen to the usual degree. This is particularly true in central California.

A study of the numbers of fish caught in each year from each year-class has led to a method of estimating year-class size from age composition data and statistics of the catch.

Applying this method to the catch and age analysis data of the fishery from 1941–42 to 1945–46 it has been found that the year-classes from 1933 to 1936 were subnormal; those of 1936, 1937, and 1940 were about average, while those of 1938 and 1939 were outstandingly good. Year-classes 1941 to 1944 have been subnormal.

It has been found that a good correlation exists between summer salinity in southern California and fluctuations in the size of year-classes. The strength of salinity is connected with the amount of upwelling off the California coast, which, in turn, is highly correlated with the prevalence of northwesterly winds during the preceding winter.

Perhaps the most significant postwar trend of the American fisheries is expansion of the industry westward into regions of the Pacific formerly exploited by Japan. The Fish and Wildlife Service has taken advantage of every opportunity to add to existing knowledge of tunas, which are the most valuable resource of that region.

Research on the North Atlantic banks has demonstrated that abundance of the haddock has declined severely during the past 3 years, owing partly to relative failure of the 1941, 1942, and 1943 year-classes. Consequently the Fish and Wildlife Service has recommended to the Atlantic States Marine Fishery Commission a course of action for restoration of haddock stocks by restricting the mesh of fishing gear to sizes that will protect young, immature fish.

MAINTAINING THE INLAND FISHERIES

Despite the fact that more people are actively engaging in outdoor recreations than ever before, our facilities in the field of fish culture have not increased correspondingly. Production of fish by Federal hatcheries has therefore been maintained with difficulty.

The demand for fish for stocking purposes so far exceeds the supply as to put a premium on the efficiency of hatchery operations. Consequently the Fish and Wildlife Service carries on biological research to minimize costs of production, improve stocks, and reduce the incidence of disease and other hazards.

One of the most urgent problems is the development of treatments for the control of diseases. Preventative methods have been developed, and applied on a production scale, and a search for new and better disinfectants has been actively prosecuted. Sulfamerazine has been found to control outbreaks of furunculosis, a disease that has killed whole populations in nature, and is extremely virulent to hatchery

TABLE 1.—*Summary, by groups, of the output of fishes and eggs during calendar year ended Dec. 31, 1946*

Group	Eggs	Fry	Fingerlings or larger	Total
Catfish (bullheads)			874, 105	874, 105
Channel catfish		120, 000	175, 050	295, 050
Mud catfish			5, 000	5, 000
Buffalofish	60, 750. 000		20, 540	60, 770, 540
Shad	2, 461, 400	9, 287, 700	195	11, 749, 295
Whitefish	780, 000	967, 300		1, 747, 300
Lake herring		4, 900, 000		4, 900, 000
Striped bass		3, 517, 000		3, 517, 000
Atlantic salmon			39, 615	39, 615
Chinook salmon	8, 940, 960	15, 768, 000	39, 171, 000	63, 879, 960
Chum salmon		3, 400, 500	70, 250	3, 470, 750
Humpback salmon			237, 010	237, 010
Landlocked salmon			57, 780	57, 780
Landlocked sockeye salmon			29, 190	29, 190
Silver salmon	51, 455	324, 000	1, 158, 355	1, 533, 810
Sockeye salmon	1, 279. 010		1, 737, 535	3, 016, 545
Steelhead trout	7, 190	50, 055	228, 885	286, 130
Rainbow trout	14, 466, 680	578, 255	7, 509, 325	22, 554, 260
Cut-throat trout	17, 872, 120	4, 741, 865	3, 250, 705	25, 864, 690
Lock Leven trout or brown trout	1, 847, 820	37, 000	2, 508, 660	4, 393, 480
Lake trout		3, 000	962, 625	965, 625
Brook trout	16, 242, 435	736, 670	5, 016, 635	21, 995, 740
Grayling	1, 737, 075		52, 400	1, 789, 475
Northern pike	8, 180, 000	200, 000	50	8, 380, 050
Crappie (black)			680, 515	680, 515
Crappie (white)			139, 105	139, 105
Largemouth black bass		3, 767, 685	5, 050, 880	8, 818, 565
Smallmouth black bass		671, 500	207. 675	879, 175
Rock bass			42, 105	42, 105
Warmouth bass			12, 630	12, 630
Yellow bass			10	10
Bluegill sunfish			16, 071, 290	16, 071, 290
Common sunfish			160	160
Green sunfish			63, 810	63, 810
Red-breasted sunfish			10, 000	10, 000
Red-eared sunfish			1, 541, 580	1, 541, 580
Round sunfish			705	705
Pickerel			50	50
Pike perch	2, 000. 000	17, 235, 000	68, 100	19, 303, 100
Yellow perch	420, 000	1, 739, 000	217, 725	2, 376, 725
Fresh-water drum			4, 000	4, 000
White perch		1, 100, 000		1, 100, 000
White bass			35	35
Cod	1, 691, 745, 000	386, 319, 000		2, 078, 064, 000
Haddock	354, 162, 700	137, 269, 200		491, 431, 900
Flounder		965, 236, 500		965, 236, 500
Pollock	716, 298, 600	113, 398, 500		829, 697, 100
Lobster		3, 147, 000	320, 800	3, 467, 800
Terrapin			10, 000	10, 000
Total	2, 899, 242, 445	1, 674, 514, 730	87, 546, 085	4, 661, 303, 260

stocks. The treatment has been standardized, and its effect on growth of the fish has been studied. Although it does not provide immunity, it does promise to be a valuable aid in controlling the sudden and disastrous outbreaks of this destructive disease in hatcheries. Meanwhile, further research is being carried on to develop immunization methods.

The shortage and prohibitively high cost of meat products such as liver have emphasized the importance of nutrition studies to develop adequate but cheaper diets. This problem is being approached scientifically by investigating the basic nutritional requirements of fish.

The culture of warm-water fishes like black bass and sunfish depends largely on the production of natural foods in ponds. The great demand for the young of these species for stocking farm ponds is taxing the capacity of hatcheries. A series of experiments has been conducted to determine the value of various agricultural fertilizers, for fertilized ponds have been found to produce twice the amount of fish.

In many farm and hatchery ponds, particularly in the South, aquatic weeds choke out the living space for the fish. Experiments have shown that new weed killers like 2,4–D, are effective for controlling the growth of emergent plants.

The rapidly expanding farm-pond construction program made it necessary to concentrate on the propagation of largemouth black bass and bluegill sunfish at the warm-water fish hatcheries for the stocking of these new waters. Experiments by the Fish and Wildlife Service, the Alabama Polytechnic Institute, and other agencies interested in the furtherance of the farm-pond program, indicate that these two species give best results under most conditions.

During the calendar year 1946 approximately 11,760,000 fish were furnished to stock farm ponds throughout the United States, an increase of 55 percent over 1945. Farm ponds constructed under the auspices of the Soil Conservation Service received 6,540,865 fish; ponds sponsored by the Agricultural Extension Service and the Production and Marketing Administration received 2,600,640 fish. During the year the Fish and Wildlife Service made 17,930 individual plantings of fish in farm ponds.

In a retrenchment program undertaken to provide funds for more efficient operation, fish-cultural operations were discontinued at certain hatcheries, including Birdsview, Wash.; Quinault, Wash.; Duluth, Minn.; Woods Hole, Mass.; Mill Creek, Calif.; Jackson Hole, Wyo.; St. Louis, Mo.; Fort Belvoir, Va.; and Pittsford, N. Y. The hatching of commercial species was discontinued at Cape Vincent, N. Y., and Edenton, N. C.

The Fish and Wildlife Service cooperates with the Great Lakes States in research dealing with the commercial fishes of their Great Lakes waters. Investigations of the growth and life history of the important species, that have been in progress for many years, are continuing.

In recent years a new menace, the sea lamprey, has appeared to plague the fisheries of the upper lakes. This parasite has spread from Lake Ontario through the canals and has now entered Lake Superior. It is feeding extensively on the valuable populations of lake trout, and is reported to be attacking the whitefish in increasing numbers. The lake trout catch in the United States waters of Lake Huron has dropped from 1,345,000 pounds a year to 41,000 pounds. This serious economic loss has impelled the States of the region and the Province of Ontario to combine their efforts to control this pest. The Fish and Wildlife Service has taken a leading part in organizing the program of investigation to determine the vulnerable points in the life history of the sea lamprey, and is devising and testing various methods of control.

UTILIZATION OF FISHERY RESOURCES

The more completely and efficiently the catch of fish is utilized, the less will be the drain on the supply; to promote such utilization the Service conducts statistical, technological, marketing, economic, and education research and services.

During the year, the marketing of fish encountered obstacles not experienced during the rush of wartime activity. The return of other protein foods to the markets in quantity and the withdrawal of military demands had created surpluses with which the industry was not well prepared to cope. During the rush of wartime business relatively little consideration had been given to methods for maintaining at least a portion of the old markets and obtaining new civilian outlets. The urgency of the situation made it necessary to give first attention to implementing those activities which promised the most benefits and at the same time to laying the groundwork for longer range development.

Service specialists in market development undertook emergency operations, such as assisting the processors of rosefish fillets to develop and carry out a campaign to move their products to market. Processors of canned whiting, filleted and canned lake herrings, and filleted and canned rockfish were aided in marketing their products.

Frozen-food locker plants, school lunch programs, and other mass food-handling or feeding establishments were cultivated in an effort to develop greater outlets for fishery products. These outlets were aided in the acquisition and use of fish through work of home economists and marketing specialists and through the dissemination of information on such matters as nature and location of supply, and the handling and preparing of fish.

One of the greatest handicaps to the advancement of the fisheries is the lack of educational facilities where specialists may be trained for the many important positions in industry, in the Government, and as instructors in schools and colleges. Efforts are being made toward training people for such positions.

Three motion-picture films dealing with large-scale filleting and packaging of fish and home cookery of fish have been televised over national chains originating in New York. One of these films has already been accorded national recognition for excellence and placed in international competition at Venice, Italy, by the State Department.

Two more films, in the process of production, will portray latest developments in the handling of fish.

In the field of economics, a comprehensive study was made of imports and import duties on fresh and frozen ground-fish fillets. These imports rose from 9.4 million pounds in 1939 to 43 million pounds in 1945, an increase of nearly 500 percent, while in the same period, American production rose from 100.4 to 134.8 million pounds, or only 35 percent. The study included surveys of costs of production in the United States, Canada, Newfoundland, and Alaska. The results of this investigation were embodied in a report for the Committee on Reciprocity Information, becoming the basis for international discussions on possible import quotas or possible changes in duties on fresh and frozen ground-fish fillets.

A study was made on the 1946 extension of unemployment insurance to certain fishing services. The economic importance of this extension, its cost to the fishery industries, and its benefits for the fishermen and allied workers were investigated. This study proved useful in connection with administrative and legislative measures in the several States which have fishery interests and with several congressional bills.

The principles of determining the valuation of fisheries in individual areas received thorough study. When the fisheries of an area are threatened by pollution, erosion, water diversion, or dams, it is essential to have a reliable method of estimating the value of the fishery resources so that the extent of damages can be determined.

The need for accurate day-to-day information on production, receipts, shipments, and stocks is probably nowhere more vital for the proper utilization of a natural resource than in the fishing industry. To supply the industry with the basic production and distribution information required for efficient marketing, fishery market news offices were operated at Boston, Mass.; New York City; Hampton, Va.; Jacksonville, Fla.; New Orleans, La.; Chicago, Ill.; Seattle, Wash.; and San Pedro, Calif. These offices, assisted by market news aides in producing centers, and a branch office at Astoria, Oreg., were able to furnish the fishing industry with current market information on the major portion of the domestic catch of fishery products.

Because of a shortage of funds, it became necessary to discontinue the Jacksonville market news office at the end of May 1947, and daily reports were issued by this office for only 11 months of the year.

To provide the basic statistical information required by the industry and the governmental agencies concerned with the fisheries, a general statistical survey was made of the fisheries in each of the coastal States. Data were collected on the number of fishermen, fishing craft, and gear engaged in the capture of fishery products, the volume and value of the catch by species, gear used, and locality of capture. Data also were assembled on employment in wholesale and manufacturing establishments and on the production of manufactured fishery commodities. The survey of the coastal fisheries, which covered activities in 1945, was the first complete canvass of these fisheries since 1940.

Various technological studies involving the chemical problems of handling fish were carried out. These included tests to determine differences in methods for sorting, brining, smoking, and processing Maine sardines; a detailed study of the chemical structure of fish oils to determine factors responsible for changes in composition; studies of packaging to learn what materials retain good appearance, texture, and flavor in frozen fishery products; and investigation of means of promoting the stability of vitamin A.

In the field of sanitation considerable progress has been made on methods of identifying the fecal streptococci, or so-called enterococci, which are known to exist only in the intestines of man and warm-blooded animals. These bacteria are probably better indices of sanitary quality than the coliform bacteria commonly used. The use of the modified sodium azide-penicillin media developed in this study has been adopted by some regulatory agencies.

With a view to assisting the expansion of the Gulf of Mexico fisheries for red snapper and grouper, both valuable species, a fishery engineer of the Service designed several items of gear, including new kinds of traps, and a new type of rod and power gurdy. These fisheries have in the past employed hand lines. To expand into new, deep-water fishing areas, different fishing methods are required.

On the Pacific coast, other engineering studies were made in connection with an 8,500-ton factory ship designed for canning and freezing fish and shellfish at sea.

RIVER BASIN STUDIES

During the fiscal year 1947, studies were conducted on many of the rivers of the United States where projects are in the planning and construction stages. Field investigations were made on about 140 Federal projects sponsored by the Corps of Engineers, Bureau of Reclamation, or Soil Conservation Service.

In the Missouri Basin, investigations were continued or initiated on 37 Bureau of Reclamation projects, one of which contains 14 units, and on 6 Corps of Engineers projects. A total of 13 reports were submitted to the sponsoring agencies. The radius of influence of the Missouri Basin development plan on fish and wildlife resources extends beyond the areas of planned development. Therefore, it is evident that a basin-wide survey of fish and wildlife resources must be made as a basis for evaluating over-all effects of a coordinated development plan. In consideration of such an approach, a basin-wide survey was initiated on January 1, 1947.

In addition to the foregoing, 20 power projects in the United States and Alaska were investigated under provisions of section 18 of the Federal Water Power Act. This act specifies that recommendations be made by the Secretary of the Interior to the Federal Power Commission for fish protective devices at dams constructed by public or private agencies under licenses issued by the Commission.

A number of other projects have been reviewed by Service biologists and engineers. Statements of Service opinion or "letters of comment" have been made particularly in those instances in which time was not available for comprehensive field investigation or for formal reports. A number of public hearings were attended by various representatives of the Service in order to keep abreast of plans being developed by the Corps of Engineers for specific river basins. Numerous conferences were held with sponsoring agencies and State conservation departments to present Service views relating to proposed improvements, to reconcile divergent views where such have arisen, and for the purpose of obtaining a better understanding of fish and wildlife needs in relation to over-all development plans. In a number of instances, the sponsors have agreed to provide measures which will reduce losses or increase benefits to fish and wildlife resources.

Negotiations were initiated with the Corps of Engineers for the establishment of refuge and wildlife management areas at reservoir areas under War Department control, such as Harlan County Reservoir, Nebraska, and two reservoirs in the Yazoo Basin, Mississippi.

FEDERAL AID TO STATE PROJECTS FOR THE RESTORATION OF WILDLIFE

The Pittman-Robertson Federal aid to wildlife restoration program has given invaluable aid to the States in their efforts to meet the increasing demands on their wildlife resources. Funds for this cooperative restoration work are derived from the 11-percent excise tax imposed on firearms, shells, and cartridges used for sporting purposes. From the funds thus accumulated, Congress annually appropriates a certain portion of this fund for apportionment to the States, which contribute 25 percent of the cost of each project. Proposed restoration projects are reviewed by the Fish and Wildlife Service for soundness of purpose and design. Nevada, the only State not hitherto participating, became eligible during the year and is expected to select and submit suitable restoration projects for approval during the fiscal year 1948.

The Pittman-Robertson Federal Aid to Wildlife Restoration Act was amended on July 24, 1946, to include the financing of 75 percent of the maintenance costs of projects, previously completed with the help of Pittman-Robertson funds and to provide that no State will receive less than one-half of 1 percent, or more than 5 percent, of the total amount apportioned to all the States.

Sales of hunting licenses during the year ended June 30, 1946, totaled 9,854,313, an increase of 1,663,412 over the previous year. All indications point to a continuation of the pronounced upward trend during the fiscal year 1947. The resulting increase in hunting pressure upon all game species makes an intensive restoration and management program increasingly important.

A total of 259 projects, obligating $2,211,627.70, were approved during the year. Projects approved included 103 surveys and investigations projects, obligating $891,177.32; 73 developmental projects, obligating $857,041.61; 49 land projects, obligating $264,999.79; 8 maintenance projects, obligating $24,596.16; and 26 coordination projects obligating $173,812.82.

The amounts collected and appropriated each year since the program started are shown in table 2, and the apportionments by States for the 1947 fiscal year are shown in table 3.

TABLE 2.—*Status of Federal aid to wildlife restoration funds*

Fiscal year	Amount collected	Amount appropriated
1939	$2, 976, 020	$1, 000, 000
1940	3, 707, 844	1, 500, 000
1941	5, 535, 773	2, 500, 000
1942	5, 072, 588	2, 750, 000
1943	1, 149, 333	1, 250, 000
1944	1, 061, 045	1, 000, 000
1945	3, 132, 402	900, 000
1946	5, 232, 465	1, 000, 000
1947	[1] 8, 423, 216	2, 500, 000
Total	36, 290, 688	14, 400, 000

[1] Amount collected from July 1, 1946, to May 31, 1947, inclusive.

CONTROL OF PREDATORS AND INJURIOUS RODENTS

The production and processing of renewable resources was materially aided during the year by the use of new and unusually effective methods of controlling rats, coyotes, and other mammals harmful to such enterprises. These methods, involving expanded use of airplanes, coyote getters, and war-born rodenticides, enabled the Service to do a bigger job in the face of higher costs than ever before in its history. Expenditures were at the rate of $1 of Federal appropriations for every $2.57 made available by agencies and individuals benefiting from the work. This cooperative predator- and rodent-control

TABLE 3.—*Apportionments of Pittman-Robertson funds for the 1947 fiscal year*

Alabama	$34,137.54
Arizona	48,050.46
Arkansas	28,721.56
California	103,273.93
Colorado	70,203.98
Connecticut	6,537.06
Delaware	5,000.00
Florida	31,285.61
Georgia	29,849.75
Idaho	48,673.85
Illinois	62,429.73
Indiana	68,538.47
Iowa	52,179.75
Kansas	44,755.82
Kentucky	25,665.94
Louisiana	35,275.28
Maine	28,365.48
Maryland	15,403.12
Massachusetts	14,809.97
Michigan	129,892.22
Minnesota	76,607.58
Mississippi	31,046.40
Missouri	57,591.42
Montana	68,753.83
Nebraska	48,283.54
Nevada	43,542.56
New Hampshire	12,920.81
New Jersey	20,276.31
New Mexico	50,267.83
New York	93,677.57
North Carolina	$35,665.41
North Dakota	34,210.45
Ohio	87,491.03
Oklahoma	42,819.49
Oregon	55,360.81
Pennsylvania	100,612.95
Rhode Island	1,715.33
South Carolina	20,603.81
South Dakota	47,750.45
Tennessee	33,844.58
Texas	119,946.33
Utah	44,189.85
Vermont	10,175.74
Virginia	36,165.42
Washington	65,044.07
West Virginia	33,792.69
Wisconsin	62,109.03
Wyoming	42,485.19
Apportioned to the States	2,260,000.00
Alaska	20,000.00
Hawaii	10,000.00
Puerto Rico	5,000.00
Virgin Islands	5,000.00
Deducted for Administration	200,000.00
Appropriation	2,500,000.00

program entailed a total expenditure of $3,673,941; $1,027,709 from regular departmental appropriations, $1,097,367 contributed by cooperating States, and $1,548,865 from cooperating counties, livestock associations, and others.

The number of predatory animals taken during the year under this cooperative program was greater than ever before, judging by results in freeing many stockmen of losses by predators. A complete count of numbers taken is impractical under the new methods now used, but the total of those counted was 112,996 (only 4,209 less than last year). The recorded take consisted of 103,982 coyotes, 1,460 wolves, 6,508 bobcats and lynxes, 919 stock-killing bears, and 127 mountain lions. In rodent control operations 12,079,044 acres of infested land were treated for the control of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, kangaroo rats, porcupines, and woodchucks. In addition, 438,011 premises were treated in cooperative campaigns for the control of house rats. Equipment and supplies used in predator and rodent control, and 617,228 pounds of rodent bait materials were distributed to cooperators throughout the country by the supply depot at Pocatello, Idaho.

Throughout the year the Service continued its policy of controlling mammals harmful to game, agriculture, forestry, and food and feed handling industries in areas where the need is greatest. The experience gained in applying new control methods to these areas places the Service in a paramount position regarding future aid in expanding the production of renewable resources. The Service is now in a position to supervise an effective predator- and rodent-control program with an extent of national coverage limited only by the amount of Federal and cooperative funds made available. It has cooperative working agreements with 33 States. Many other agreements provide for cooperation with counties, cities, livestock associations, and others. These agreements specify supervision by the Service, thus assuring use of necessary safeguards and strict technical procedure without which several of the newer control methods would be dangerous to domestic animals and the public.

PROTECTION OF LIVESTOCK AND GAME

Although manpower has been inadequate to meet all demands for control of animals destructive to livestock, poultry, and game, the more critical areas have been covered unusually well, due to use of new control methods. Improved control of predators has enabled many ranchers to complete their spring lambing this year with little or no loss on ranges where coyotes and other predators formerly killed from 5 to 15 percent of the new-born lambs. Similar success has occurred on cattle ranges where local groups of coyotes had acquired calf-killing habits. A number of such trouble spots were quickly relieved of predators by Service hunters equipped with airplanes.

Airplanes were used on cooperative control programs in nine States: Colorado, Idaho, Montana, North Dakota, Nevada, Oregon, South Dakota, Utah, and Wyoming. A total of 25 planes were used; 4 owned by the Service, 5 owned and made available by cooperators and Service employees and 16 private planes hired on contract. These planes, in a total flying time of approximately 1,400 hours, made it possible for a small force of hunters to cover large areas at a low average cost of 67 cents per square mile.

Another relatively new control method, the "coyote-getter," has been given intensive application with very good results. In Maverick County, Tex., a Service supervisor demonstrated the possibilities of this set-gun device by taking 522 coyotes in 1 month. His best day's catch was 46 coyotes, made on a line of 160 sets, 39 miles long, which he had placed the previous day. This record far surpasses all previous monthly takes by Service hunters using traps or any other methods. Coyote-getters are now widely used wherever cooperative predator control is being conducted in the Western States, and numerous letters from ranchers tell of resultant decreases in losses from coyotes.

Still another new method of coyote control, involving the carefully controlled use of the war-developed poison known as compound 1080, was put into general use for the first time this year. Precautions developed during several years of research have been closely followed so as to avoid harm to humans, domestic animals, and valuable fur animals. All such work is done only under well trained and disciplined supervisors, and a shortage of men has caused the Service to limit 1080 operations below actual need rather than risk the danger of placing it in untrained hands. It was used this year on selected areas having critical predator problems in the 11 Western States, as well as in western South Dakota and northern Texas. Results have exceeded expectations in all cases.

The control of rats destructive to food and feed stuffs has been continued by the Service in cooperation with States, counties, farm associations, and individuals. The demand for this work has far exceeded the amount possible for the Service to do with its limited facilities but increasing use of compound 1080 has greatly aided the program. This new poison has also increased the effectiveness of control programs against field rodents destructive to range vegetation. Considerable work has also been done to protect orchards from the attacks of tree-girdling mice, and to reduce the damage done by rabbits and porcupines on forested lands.

In spite of phenomenal results obtained with compound 1080 and other powerful rodenticides, the cooperative work done by the Service has scarcely scratched the surface of the rat-control problem in the United States. Nearly every family in the country sustains some loss each year from rat depredations upon food; in addition many cases of disease are transmitted by rats.

The protection of the public from such diseases as rabies, plague, and typhus is an incidental but highly important aspect of the control of predators and rodents that are economically destructive. The Service works in cooperation with the Public Health Service, and State, county or municipal health organizations on all animal control where transmission of disease to humans is concerned. Cooperation is also extended to the Bureau of Animal Industry, United States Department of Agriculture, regarding diseases of domestic animals that may be transmitted by wild animals. For example, a well qualified employee of the Service was recently transferred to Mexico City to direct the control of wild-animal carriers of foot and mouth disease, which is being fought cooperatively by the Mexican and United States authorities.

An illustration of the way in which reduction of rats destructive to food has also diminished the incidence of rat-borne disease is seen in Louisiana where the Service is cooperating with the State health department in a rat-control program. This program, in addition to reducing rat damage in stores and warehouses, has resulted in a 50-percent reduction of typhus fever cases, according to latest available statistics.

ADMINISTRATION OF FEDERAL STATUTES FOR PROTECTION OF WILDLIFE

The eight principal statutes administered by the Service for the protection of wildlife are the Migratory Bird Treaty Act, Lacey Act, Migratory Bird Conservation Act, Migratory Bird Hunting Stamp Act, law protecting wildlife and property on Federal refuges, Black Bass Law, Bald Eagle Act, and the Alaska game law.

These laws and the regulations thereunder are enforced in the United States by 5 regional supervisors of law enforcement and 65 United States game management agents, who, either working alone or with State officers and United States deputy game wardens obtained 2,358 convictions, with fines and costs aggregating $87,501.88.

TABLE 4.—*Summary of penalties imposed during the year for violations of wildlife conservation laws, 1946–47*

Act	Convictions	Fines and costs	Jail sentences
			Days
Migratory Bird Treaty Act	529	$21,492.65	290
Migratory Bird Conservation Act	50	715.00	366
Migratory Bird Hunting Stamp Act	69	1,596.20	
Wildlife Refuge Trespass Act	2	1.00	
Lacey Act	8	4,450.00	
State prosecution from Lacey Act investigations	113	3,812.00	345
State laws, cooperative prosecutions	2,358	87,501.88	
Total	3,129	119,568.73	1,001

All agents of the Service cooperate closely with officers of other Federal and State agencies and contribute materially to game management activities other than law enforcement. In parts of the United States game management agents devote a large percentage of their time to control of migratory birds when unusual concentrations of them seriously threaten the profitable growing of fruit, grain, and seed crops.

A total of 2,119 importation permits were issued compared to 2,134 the previous fiscal year. These authorized the entry of 191,360 birds and 43,794 mammals, compared with only 55,857 birds and 27,675 mammals last year. The removal, during the past year of wartime restrictions on this type of air cargo is in part responsible for this increase in traffic in live birds and mammals.

Migratory bird permits issued during the fiscal year were as follows: To collect for scientific purposes, 295 (167 last year); for propa-

TABLE 5.—*Cases of violations of the Migratory Bird Treaty Act disposed of during the year, and cases still pending on June 30, 1947*

Disposition:	
Conviction	520
Dismissal	9
Nol-pros	47
Found not guilty, jury trial	16
Found not guilty by court	5
No bill rendered	0
Total	597

Pending:	
From preceding year	78
New cases	630
Total	708
Disposed of during year	597
Pending at end of year	111

gating purposes, 283 (253 last year); to take for propagation, 20 (20 last year); banding, 81 (50 last year). A total of 45,081 migratory waterfowl were raised under Federal propagating permits, an increase over last year of 2,081. The number sold for food was 16,274 and 7,373 were liberated. Last year 19,137 were sold for food and 6,911 liberated.

Propagating permits totaling 690 and scientific permits totaling 294 were canceled and revoked during the year. At the end of the fiscal year outstanding permits were as follows: propagating, 3,351; scientific collection, 1,805; scientific possession, 581; special possession, 3,383.

Depredation permits issued from the offices of the regional directors to alleviate crop damages by migratory birds numbered 684, a decrease of 40 from the previous year.

The National Park Service

NEWTON B. DRURY, DIRECTOR

". . . to save from destruction the wild beauty of America"—*John Muir*

THE fiscal year which ended on June 30, 1947, was, in some respects, a red-letter period for the National Park Service and for the great system it administers. A part of Florida's semitropical Everglades became the Everglades National Park; an appropriation item of $200,000 was approved by both House and Senate for a start on the Service's program of acquiring private and non-Federal lands within the boundaries of park areas; the establishment of the Concessions Advisory Group launched a thoroughgoing study of the whole concessions system; the extent and effectiveness of the Service's cooperation with other agencies, Federal and State, have steadily increased; a start has been made on the repair and rehabilitation of structures and facilities, though appropriations for the purpose have not been equal to the need; and the popularity of the parks and monuments has reached a new high.

On the opposite side of the ledger must be placed the serious insufficiency of funds for adequate field or central office staffs or vitally needed developments; renewed threats to Olympic National Park and Jackson Hole National Monument; and the serious inadequacy of visitor accommodations of all kinds.

There are two facts which stand out in any review of the year. The first is the tremendous influx of visitors to the National Park System, which reached a record total of 21,682,782 in the travel year that ended on September 30, 1946, and which appears certain to exceed 25,000,000 during the present travel year.

On the whole, we believe that these visitors have been satisfied. To many the year brought a renewal of prewar experience; to thousands of others it brought, for the first time, acquaintance with the finest examples of the American natural scene and with those historic places where American enterprise and patriotism have flowered most gloriously.

The second outstanding fact is that neither the physical plant—Government or concessioner—nor the staffs, either in central offices or in the field, were adequate to meet the responsibilities greatly enlarged both by the addition of new areas and the increase in visitors.

Mount Rainier for example.—The situation at Mount Rainier National Park is typical. At this writing it seems not at all unlikely that visitors to the park during the current travel year will exceed 1,000,000. The amount of public accommodation is materially below that available before the war; almost all of what remains is obsolete or obsolescent and none too safe.

The park contains 80 miles of highway. Much of it is in various stages of disrepair; the West Side Road is rapidly deteriorating, while part of the Carbon River Road is, in the words of the superintendent, "rapidly going back to its natural state." Hundreds of thousands of dollars were expended before the war on the Stevens Canyon Road to connect the Paradise Valley Road with the southeast corner of the park, but it will require close to a million dollars to complete. Not a mile of new road has been opened to the public in this park since 1940.

All public camp grounds require extensive improvements. Housing, which must be provided within the park for Service employees, is still inadequate, though temporary relief has been provided by conversion of a mess hall at Longmire into apartments, and others will be developed in prefabricated barracks obtained from surplus—a type of construction wholly unsuitable in a national park.

The staff at Mount Rainier National Park, handling twice as many visitors as it did before the war, is actually smaller than it was in 1940, the record prewar year. Meantime, the 40-hour week has reduced worktime by one-sixth; protection at one-man posts such as remote ranger stations must perforce be limited to 5 days a week.

Situation duplicated in many areas.—The situation at Mount Rainier has been thus covered in detail in order to provide a vivid and concrete picture of a typical situation in the National Park System. Conditions in this park are duplicated in many respects in most of the others, where increased use has not been matched by increases in staff or in public accommodation; where, in fact, there have as a rule been actual decreases in both respects, along with deterioration in both public and administrative facilities.

Travel to Mesa Verde National Park, just before and just after World War II, was more than twice what it was during the early thirties, yet the staff of seasonal and permanent employees available for protection of prehistoric ruins and for conducting guided trips is considerably smaller now. At Zion and Bryce Canyon National Parks virtually all the time of the ranger force is required during 8 months of the year to operate the two checking stations—and then on such a limited basis that considerable revenue in automobile fees must go uncollected. At Petrified Forest National Monument, all staff members took turns at janitorial duties in public rest rooms and museums; rangers on checking stations performed duties singly, where formerly, for fewer visitors, two were employed. With no relief, contact rangers frequently talked almost continuously for 8 hours, and could not speak above a whisper at the end of the day!

At Glacier National Park, all members of the permanent ranger staff, as well as other employees, have voluntarily worked many extra hours to provide protection to the park and service to the public. Accidents to employees have increased one-third, with a 200 percent increase in time lost. The superintendent declares that this "is largely due to overload of work. Two accidents resulting in long periods of time lost were caused by working under pressure. * * * Poor planning and improper equipment have been contributing factors, but this is traceable to pressure of work that did not allow time for making alterations or repairs to eliminate hazards."

"Every branch of this administrative unit is understaffed and every branch head, with his various assistants, has more duties than he can possibly perform," the superintendent of Big Bend National Park reports. "All we can do is try to select the more important problems and delay action on those that appear minor in nature. * * * A chief ranger and three rangers cannot keep control over everything on a 700,000-acre tract, especially when there are no checking stations and the boundary is not fenced."

At Death Valley National Monument in California, the heavy travel (46 percent above the highest previous years) put a heavy strain on the protective and educational forces. On 3 days each week only one ranger was available, and on 4 days there were two. With approximately 500 miles of road to patrol in this 1,850,565-acre monument, justice could not be done to wildlife protection, janitor work in the heavily used camp ground, roadside clean-up and many other duties. "The entire road system is depreciating rapidly," says the superintendent, "and with no major rehabilitation possible for several years, the problem is rapidly getting out of hand."

Throughout the National Park System public accommodation is provided, with relatively few exceptions, by private capital, invested in hotels, lodges, cabins, restaurants, cafeterias, lunch counters and stores, operated under contract with, and subject to regulation by, the Federal Government. Difficulties in obtaining materials and skilled labor for the repair of facilities which deteriorated during the war in some cases prevented the placing of such facilities in service; during 1946, difficulties of obtaining competent help and of retaining it, kept other usable facilities idle. Investment in new facilities has been almost completely lacking because of uncertainties as to the terms of new concession contracts, held in abeyance pending report by the Concessions Advisory Group, referred to later.

To curb the careless and the vandalistic; to provide protection to the visitor and the modest degree of interpretation which contributes so much to his enjoyment; to safeguard invaluable natural and historical resources "unimpaired for the enjoyment of future generations"—to perform these functions with even fair adequacy is utterly impossible under existing circumstances. That it is done as well as it is shows a devotion to duty on the part of both field and central office personnel that is beyond praise. It is bound sooner or later, however, to affect the health and the capacity for accomplishment of those who, for weeks on end, give their Government 6 and 7 days of service for 5 days' pay because they can see no other way in which the requirements of law and their own consciences can be met.

The 40-hour week, in its universal application within the Federal Government, has produced great difficulties for the National Park Service. These difficulties are not insuperable, but they cannot be surmounted without frankly recognizing the extra costs entailed. There is needed a considerable degree of flexibility in the authorization of a longer work week. Sufficient funds are needed to defray the costs of fully justified overtime. This is not recognized in current appropriations. When the District Ranger at Mount Rainier, alone at his station, takes his permissible 2 days per week off, the lands and properties he is expected to guard simply go unguarded; when 5-days-a-week employment has to compete with 6-days-a-week private employment at the same daily wage, there is no choice but to pay time-and-a-half for the extra day of work, if employment is to be effected at all, thereby draining funds sorely needed for other purposes. When back-of-the-line services—accounting, personnel, budget, supervision of concessions, auditing, the issuance and distribution of informational publications, guidance in planning and construction, and many others—already insufficiently supplied with personnel, are compelled to undergo further decreases, the whole operation suffers; and loyal and faithful employees gird themselves to contribute further uncompensated overtime.

We cannot believe that the millions of Americans who derive enjoyment and physical and spiritual satisfaction from such possessions as the national parks wish to obtain that enjoyment and satisfaction at such a cost.

Areas suffer from overuse and vandalism.—The properties which the National Park Service is charged with safeguarding and protecting suffer in two different ways as a result of insufficient protective staffs and of inadequate developments. Where, for example, the demand for camping space exceeds the supply, it must either overflow into space not designed for such use or overcrowd the available developed camp grounds. In either case, vegetation is subjected to excessive wear with no chance to recover. In a score of ways, use which is legitimate and desirable but beyond capacity, damages both natural features and man-made facilities.

Insufficient protection, on the other hand, is an open invitation to those who do not respect the property of others—even when they are themselves part owners—to commit acts of carelessness or willful vandalism. Superintendents and custodians were asked specifically to comment on the incidence and character of such vandalism and to explain the volume of it where it seemed excessive. The Superintendent of Grand Teton National Park declared, "The answer to the problem lies in additional ranger personnel for patrol and informational duty, more adequate signs and less congested areas of use." His statement reflects the observations of all those who found themselves troubled by vandalism—which included the overwhelming majority.

Grand Teton reported heavy damage to comfort stations and other buildings; the burning of tables, signs, and outdoor amphitheater seats in campfires; the indiscriminate hacking of trees and shrubs—even the disappearance of the supports of the naturalist's motion-picture screen. A veteran park superintendent contends that the worst damage is done by crowds beyond the capacity of the existing facilities, particularly camp grounds, and that the effects of such overuse can be remedied only by additional developments which will allow the overused areas to recover.

Fools' names.—At Zion National Park, the writing of names and addresses on scenic features moved the superintendent to send a carefully composed letter to 20 of the writers, with excellent results. Two juvenile hoodlums, who set fire to an old CCC building at Capitol Reef National Monument, were apprehended by the FBI and confessed the crime. Their case was set for August in Federal Court. At Petrified Forest National Monument, initials, dates and pictures were scratched over prehistoric Indian pictures at Newspaper Rock. This point was formerly patrolled by a guide, whose services it has not been possible to provide since the end of the war.

At Crater Lake National Park the superintendent reports bottles beside and on roads, scattered papers, film cartons, and camp refuse "with a total disregard of sanitation, cleanliness, and consideration of the person who came after them."

Injuries to rare plants are among the more destructive forms of vandalism reported from Hawaii National Park. "Damage will continue," writes the superintendent, "as long as our ranger ceiling remains at its present level."

Exhibits destroyed.—At Grand Canyon, one of three cases at the Colorado River trailside exhibit was completely wrecked. The large plate-glass cover, carried down into the canyon by CCC manpower in prewar days because it was too large for muleback transportation, was destroyed, and the exhibit materials were destroyed or carried away. Binoculars at Yavapai observation station have been badly damaged, and various exhibits there have been destroyed or stolen.

"Much if not all of this wanton destruction at Yavapai could be prevented," Superintendent Bryant asserts, "if sufficient personnel were available to have someone on duty at this station during daylight hours."

Damage to and theft or destruction of exhibits were reported from many areas. Yellowstone National Park, with an overwhelming influx of visitors that will approach 1,000,000 this year, suffers from all the common forms of vandalism and has several serious types peculiar to it. Perhaps the worst is the throwing of rocks and all manner of trash into the hot springs, often in such volume as to impede or block the flow of the waters; with the scratching of names and initials in the delicate formations around the springs a close second.

The discouraging feature of so much of this vandalism is that evidence of it prompts others to follow suit, and there are not enough employees to remove trash or eliminate carved names promptly.

The gloomy picture presented by the above examples leads to but one conclusion: Unless adequate forces are provided for patrol and the enforcement of regulations, the valuable and irreplaceable properties of the people in the national parks will undergo steady deterioration, and the areas will gradually lose their greatness and their beauty.

Appropriations for 1948.—Difficulties of operation during the year just ended, and the insufficiency of personnel at all levels, are likely to increase rather than diminish during the fiscal year 1948, except for a degree of relief to the 28 national parks, which received an appropriation of $3,565,000. This represents an increase, after deducting nonrecurring items, of $239,925 over the 1947 amount. Funds for the Director's office were reduced by $84,000 and for the four regional offices by $72,000. For the national monuments, historical and military areas there was an increase of $12,349, plus supplemental items for the newly established Theodore Roosevelt National Memorial Park and for certain improvements at Mount Rushmore National Memorial.

Reductions are actually greater and increases materially less than the dollar figures indicate, since the costs of wages, materials, and equipment are considerably higher than the average for the 1947 fiscal year.

The budget item of $5,000,000 for roads and trails and physical improvements was reduced to $2,150,000—$350,000 less than the engineers' estimate of the cost of road and trail maintenance alone.

Sum of $200,000 appropriated for land purchases.—Perhaps the most significant item and certainly one of the most encouraging, in the 1948 appropriation, was one of $200,000 for the purchase of lands.

Although it would take considerably more than 100 years to buy up the non-Federal lands within the parks and monuments at the rate of $200,000 a year, still this modest sum will make possible the acquisition of a few key properties which block either effective control or satisfactory development as long as they are in private hands. Valuable as these results may be, however, the real significance lies in the fact that the Congress has recognized the necessity of launching a program to consolidate Federal ownership within Service areas. It is hoped, however, that in future years, acquisition may proceed at a greatly accelerated rate, since delay has resulted already in a disheartening increase in land values and in developments which have greatly added to the ultimate purchase cost and injured the parks.

Publications program limited.—To meet the needs of inquirers and visitors, the National Park Service should issue some 6,000,000 pieces of free informational literature each year. Funds for 1947 were sufficient to produce barely one-half that amount. Increases in printing costs during the year, with no increase in printing funds for 1948, will compel a still further decrease in the quantity produced this year, even though many items are being reduced in size. The backlog of special publications, prepared at considerable cost to the Government, and unproductive until they can be printed, cannot be touched.

RECREATIONAL AREAS LAG IN DEVELOPMENT

To the group of impounded lakes on which recreational use is managed by the National Park Service for another Federal agency, Franklin D. Roosevelt Lake, created by the Grand Coulee Dam, was added during the past year. The extent of responsibility involved in the development and management of the recreational areas is indicated by the 1,171,736 visitors to the Lake Mead (formerly Boulder Dam) Recreational Area during the last travel year and by a recent estimate of the supervisor at Lake Texoma that the total recreation-use visitation there this year will be as much as 650,000.

Each of these areas presents pressing problems of safe and adequate water supply, proper sanitary facilities, adequate camping facilities, water-front structures, roads, trails, concession contracts, water patrol, lifeguard service and, in general, the provision of competent and sufficient staffs to control public use and to assure proper protection of the public. The task is complicated on most of them by the fact that public land ownership around the shores of the lakes bears no logical relationship to the needs of recreation seekers, and by the fact that public demand for use, and actual public use, does not wait the orderly process of development with limited funds, and thereby complicates both the developmental and administrative tasks of the Service. Many persons, ignorant alike of the cost of adequate development and satisfactory management and of the paucity of funds available for these purposes, are likely to pass unflattering judgment on the kind of job performed by the National Park Service at these places.

CONSTRUCTION LIMITATIONS SLOW NEEDED DEVELOPMENTS

The National Park Service embarked upon the fiscal year 1947 expecting to launch as quickly as possible, and to accomplish as rapidly as possible, a program of physical improvements, parkway, road and trail construction, and repair and rehabilitation. It was sorely needed. For 5 years there had been no new construction and only inadequate maintenance of structures and utilities throughout the entire park system. Before the program could be fairly started, however, executive limitations on Federal construction, in the interests of the housing program, compelled the deferment of most park construction until last spring. Not only did this prevent work that would have been of service during the season of travel; during the period of delay, already high construction costs continued to soar still higher.

Appropriations for 1947 amounted to $11,000,000 for parkway construction and operation; $6,000,000 for the construction and maintenance of roads and trails; and $1,330,000 for the construction, repair and rehabilitation of buildings and utilities. With the removal of restrictions in the spring, every effort was made to expedite the letting of contracts and to initiate work on several day-labor projects. The end of the fiscal year brought this meager record of accomplishment:

For the entire National Park System only one road contract, for approximately 5 miles of bituminous surfacing, costing $48,619, was completed in the fiscal year 1947. Two day-labor projects, to cost $69,100, were started. Four contracts, for a total cost of $627,972, were awarded. However, on one contract for which bids were invited, the low bid of $36,566 was nearly 60 percent in excess of the estimate and was rejected; on three other invitations, for work at an estimated cost of $458,342, no bids were received.

Parkway bids far exceed estimates.—For the parkways—Blue Ridge, Natchez Trace, and George Washington Memorial, the record is not materially different. At the beginning of the fiscal year, one contract of $423,342 was under way on the Blue Ridge Parkway. Four additional parkway contracts were let for a total of $1,419,863. Seven additional invitations were issued, of which the award of one, at an estimated cost of $118,000, was pending at the end of the fiscal year. The engineers' estimate of cost for the other six was $904,982. The sum of the lowest bids was $1,155,250.50, more than 27 percent above the estimates. All were rejected.

Because of unexpended balances remaining from the 1947 appropriation the President's budget recommended only $1,000,000 additional for highway construction and reconstruction in 1948, together with $2,500,000 for repair and maintenance, and no additional appropriation for parkways. However, the appropriations as finally approved provided only $1,415,000 in new funds for construction, repair, and maintenance of roads and trails. It is therefore necessary this year to utilize more than $1,000,000 from last year's construction balances for repair and maintenance, as this work cannot be done for less than $2,500,000 per year, thus reducing by $1,000,000 the year's program of construction.

Rehabilitation and deferred maintenance just begun.—Coming out of the war period with a heavy load of deferred maintenance and repair of structures and utilities and extremely pressing need of a large amount of new construction, the Service received for all these purposes a 1947 appropriation of $1,330,000. It was compelled to defer the expenditure of much of this because of the August 6, 1946, order already referred to. Though not sufficient to permit more than a start on repair and rehabilitation, this appropriation has permitted the initiation of much work that was vital—the rehabilitation of camp grounds, repair of water and sewer lines and other utilities, painting and repair of structures, and a great variety of other jobs necessary in the interest of public health and safety. The budget request for $1,500,000 for these same purposes for this year was reduced by Congress to $735,000. In consequence, further repair and rehabilitation and further provision of needed structures—particularly employee housing in locations where provision for it with public funds is an inescapable obligation—must proceed at a proportionately slower pace.

SYSTEM NEEDS LARGE IMPROVEMENT PROGRAM

"In the National Parks," writes Superintendent John R. White of Sequoia and Kings Canyon National Parks, "we have always been in the position of engineers compelled to dam a stream in flood without opportunity to divert the flood waters."

Never have the inadequacies of development of the National Park System been so highlighted as during the travel seasons of 1946 and

1947, which have brought such tremendous increases in numbers of visitors. Camp grounds, poorly equipped and crowded far beyond the capacities for which they were planned; road systems in need of thorough overhauling and extension; utilities which were more than adequate 15 years ago, but pitifully inadequate for present demand; hotel and lodge and cabin accommodations vastly in need of enlargement and modernization—these are some of the conditions which visitors this year and last have noted and on which many of them have commented in terms of bitter complaint. In fairness it should be stated that these criticisms cannot be met until the Government is in a position to provide funds commensurate with the manifest needs.

The National Park Service's objective, often stated, is to make such provision for the public enjoyment of the areas it administers as can be supplied without serious impairment of their natural or historic features. Careful and competent studies of physical development requirements reveal that the foreseeable needs of the system, as now constituted, call for the expenditure of $98,000,000 for physical improvements, including what are generally referred to as concession facilities; $110,000,000 for the extension and modernization of roads and trails systems; and $120,000,000 for the completion of parkways already authorized.

The Service could utilize effectively as much as $15,000,000 a year for each of these items, for at least 7 years.

Larger appropriations promote economical expenditure.—Aside from the fact that sums greatly in excess of those provided during the past 2 years are needed in order to bring developments in line with existing needs, larger scale appropriations would mean economy in the long run. They would permit the completion of whole projects in a single operation, instead of prolonging them over several years. The larger contracts thereby made possible would result in a lowering of costs below those obtainable when several segments of a project have to be covered by as many contracts.

An indication of the volume of construction now needed, or that is certain to be needed before it could be provided even if funds are available on the scale suggested above, is shown by such facts as these:

There is, throughout the National Park Service, an acute shortage of housing for employees. It is estimated that 600 dwelling units, costing at least $8,000,000, will be required to alleviate this condition. Great Smoky Mountains, Mammoth Cave, Shenandoah, Rocky Mountain, Glacier, Big Bend, Mesa Verde, Hawaii, Sequoia-Kings Canyon, Everglades, and Mount Rainier National Parks; Badlands National Monument; and Lake Mead and Lake Texoma Recreational Areas—to name only a few—all are in critical need of additional housing which cannot be provided satisfactorily in any other manner than by public construction. Many other types of shortages will have to be met before the Service can perform the functions properly expected of it.

How to provide public accommodations.—With greatly enlarged demand for additional lodging and dining accommodations at many areas in the system, on the one hand, and, on the other hand, a growing hesitancy on the part of owners of capital to invest it in providing these facilities, the Service is forced to consider a program of constructing them with public funds, for operation by either private corporations or nonprofit-distributing agencies. The needs of largely undeveloped areas such as Big Bend, Olympic, and Isle Royale National Parks are urgent. The time is not far distant when the new Everglades National Park will face the same problem. In established areas such as Yellowstone, Yosemite, Mount Rainier, and Mammoth Cave National Parks, mounting travel makes the need no less urgent. To provide adequately for visitors, new construction of this type that would cost some $10,000,000 would be needed for the system as a whole, if it were the policy of the Government to undertake it. Exclusive of what might be needed to carry out a policy of Government ownership of public accommodations, the provision of other needed physical improvements would require nearly $80,000,000. At the Statue of Liberty, for example, where conditions have resulted in much criticism by New York newspapers and by many individuals and organizations, the satisfactory development of this American shrine, in order to give it a proper setting and take care of the public properly, would require the expenditure of more than $1,100,000. Developments for a well-rounded use of Great Smoky Mountains National Park and to meet present justified criticisms of lack of balance, call for expenditures of more than $1,200,000. At long-established Grand Canyon, projected developments to meet the vastly increased visitor load will cost nearly $600,000. Examples such as these could be presented for a large number of areas in the system, where existing plants are obsolete or obsolescent, as well as totally inadequate for a visitor load several times that for which they were originally planned. There have been almost no major developments in any of the parks for the past 15 years. Fifteen years ago, visitors to the then 22 national parks totaled approximately 3,000,000; for the present travel year, in 27 national parks, it will approach or exceed 11,000,000. Comparison of those two figures alone seems to us to prove the necessity of a large-scale, long-range program of physical improvements, which would be matched by a program of modernization of highway systems and their extension where there is proved need of it.

Plans in readiness for start.—The readiness of the Service to embark on needed construction programs is indicated by the fact that plans have been prepared for physical improvement projects estimated to cost $5,200,000. Plans and surveys for various minor roads and trails projects to cost $1,100,000 are available.

The Public Roads Administration has completed plans, surveys, and estimates on a total of $4,151,000 worth of major roads projects, while similar work on projects to cost approximately $8,000,000 additional are in various stages of completion. The same agency has completed, or nearly completed, similar preparation for the construction of $21,007,600 of future parkway road projects.

ADVISORY GROUP STUDYING CONCESSIONS

The complexities of the national park concessions problem were discussed at some length in last year's report. At the Service's suggestion, Secretary Krug last fall appointed a Concessions Advisory Group of five persons, to study the whole field of concessions operations and to formulate recommendations, with respect to all phases of them, designed to assure satisfactory service to the public, a reasonable return to the Government, and a reasonable profit on investment.

In their report on the 1947 Interior Department appropriation, the Appropriations Committee of the House of Representatives commented unfavorably on national park concession operations and demanded that the Service make a study designed to effect improvements. In its report on the 1948 appropriation act the committee criticized the enlistment of an outside group to undertake the task. The report was insistent that, with respect to concession services, (*a*) prices be decreased, (*b*) the Treasury receive a greater return and (*c*) concessions "monopolies" in the parks be brought to an end.

It was explained to the committee that, as one of the principal parties concerned, the Service could not, even if personnel were available for it, handle such a study in the dispassionate fashion that the situation demands if the conclusions and recommendations are to carry the necessary weight with Congress and the public. To perform the job, Secretary Krug chose a group of persons of the highest character and specially qualified in their several fields. Mr. Clem W. Collins of Denver, who acts as chairman of the group, is a past president of the American Institute of Accountants; Mr. George D. Smith of San Francisco is a past president of the American Hotel Association; Mr. Elmer Jenkins, of Washington, D. C., heads the Touring Bureau of the American Automobile Association; Mr. Charles G. Woodbury, also of Washington, is a member of the board of both the National Parks Association and the Wilderness Society; while Mr. Charles P. Taft, of Cincinnati, nationally known for leadership in civic and religious affairs, was chosen to represent the general public, whose interests are also the primary concern of the National Park Service.

To their task, the members of the group have given the intelligent attention which was confidently expected of them when they were selected. It is hoped that they may have finished their study and made recommendations to the Secretary before the end of this calendar year. This is highly desirable in order that interested members of the Congress may have an early opportunity to study the concessions policy proposed by the Secretary as a result of the report. An equally compelling reason is that a number of existing concession contracts expire at the end of the year or have already expired and have been extended to December 31. Meantime, uncertain as to the terms under which they are to be permitted to operate, most of the concessioners are refraining from further large investment even though there is great need both for additional accommodations and for major rehabilitation of existing facilities. Seldom in the history of the National Park Service has the need for decision as to future policy and procedure been more urgent.

Meantime, the Service recognizes the desirability both of lower rates to the public and of greater return to the Treasury if they are attainable; it awaits, with fully as much interest as do the members of the House Appropriations Committee, the advisory group's conclusions.

Demands on concessioners increase.—As has been indicated elsewhere, the greatly increased travel has brought with it a comparable increase in the demand for accommodations and services of all kinds. Because of shortages in labor, materials, supplies, and equipment, the concessioners were unable to render complete service, but it was, on the whole, satisfactory, and complaints were relatively few. As rapidly as they can, they are rehabilitating and effecting minor expansion of their facilities.

Heavy demand in a number of park areas made it necessary to authorize limits of 3 to 5 days in the stay of visitors at any one location. Such action was optional on the part of the concessioners when concurred in by the superintendent.

Audits lag.—Because of insufficient personnel and operating funds, the number of unaudited annual reports of concessioners increased from 513 to 565 during the year; 185 were received and only 133 were audited. The increase in number of concessioners and the addition of new areas have increased every phase of the work of the Branch of Concessions. These factors and the reduction in funds for audit, inspection, and contract negotiations have almost immobilized the branch, limiting activities mainly to office work.

Concession employees.—To preserve the wholesome atmosphere of service engendered by the use of nonprofessional help and to protect the worker are the objectives of new regulations governing the hours of labor and the wages of national park concession employees which are now being formulated. These will provide for basic rates of pay and a salary rate for each classification; overtime and holiday pay rates; employee benefits as to vacations, promotions, and seniority; satisfactory working and living conditions; and methods of determing the value of meals and lodgings for employees. They will also establish a labor review committee.

EARNINGS AT RECORD FIGURE

The earnings of the National Park System from all sources, during the 1947 fiscal year, amounted to $2,982,205, establishing a new record. By far the largest single source of revenue was the automobile fee, producing $1,594,080; other fees produced $781,249. Receipts from concession operations amounted to $265,023, much above any previous year.

In a number of parks, income materially exceeds operation expenditures. Visitors who realize that large sums are being collected in fees of one kind or another, are frequently puzzled because these funds are not utilized to provide adequate personnel and to keep the physical plant in better shape. Many doubtless assume the Service is failing to make effective use of its funds. To those who ask, it is possible to explain that all receipts go into miscellaneous receipts in the United States Treasury and that the National Park Service must depend wholly on funds appropriated by the Congress.

It should perhaps be emphasized that, though income amounts to a respectable sum, the costs of operation of the National Park System far exceed it. There are doubtless acceptable methods by which income might be increased. Any effort to make it cover even operation costs, however, could succeed, we believe, only by introducing activities and facilities wholly incompatible with the basic purposes of the system. The present fee system contains inequities that need to be adjusted; the Service's study of fees is nearing completion and recommendations for changes are expected to be formulated before the end of the year.

The fact that, almost alone among the Federal land-administering agencies, the National Park Service is not permitted to share its income with the States for the benefit of the counties, continues to place it at a disadvantage in its local relationships. This is perhaps the most important reason for the frequent local opposition to the establishment of new areas in the system, or the extension of those already established.

PLANNING, PROTECTION, AND USE

Everglades National Park.—The family of national parks was increased to 28 on June 20, 1947. On that date, Secretary Krug, accepting various conveyances from the State of Florida, and a check for $2,000,000, appropriated for land acquisition by the Florida Legislature, signed a formal proclamation of establishment of the Everglades National Park, containing a gross area of approximately 464,000 acres. Of this total, 270,000 acres are in Federal ownership, free of all reservations and encumbrances.

The brief ceremonies of June 20 were the major result of the well-directed efforts of the Everglades National Park Commission, reactivated by Governor Caldwell last year. As a result of its work, the Florida Legislature gave overwhelming support to all measures needed to assure establishment of the park. That the project did not die long ago is due largely to the continued, persistent missionary work of Ernest F. Coe, and of the Everglades National Park Association. That so much in the way of animal and bird life worth saving remains in the Everglades is largely owed to the courageous protection given it by the National Association of Audubon Societies, which cost the lives of two of its wardens.

United States Senator Spessard L. Holland, who as Governor had strongly supported the park project, has continued as an active advocate of it in the Congress.

The park being still far from complete, the first need is congressional authorization to extend it to approximately three times its present gross area, with as rapid acquisition as possible within the enlarged authorization. Much of the area has been extensively modified in one way or another and the process of restoration to something as close as possible to its original condition will be slow. Development plans are in the making, but the National Park Service, dealing with a type of terrain and biological features easily susceptible to injury or modification, proposes to move with caution in providing for public access and use. Particularly is this true of the rookeries and bird colonies that are one of the unique and fascinating features of the Everglades. It takes time to plan for public enjoyment of such spectacles and yet avoid disturbances that would destroy the very thing that the public seeks to enjoy. The people of Florida, although eager to have the park become a major tourist attraction, are sympathetic with this problem.

Cooperative planning program.—The cooperation rendered by the National Park Service to other Federal agencies and to the States was greatly extended during the year. Funds transferred by the Corps of Engineers and the Bureau of Reclamation enabled the Service to advance considerably the program of investigating recreational potentialities connected with the development of reservoirs for flood control, irrigation and power generation. In these studies an important concern of the Service is to recognize potential damage to national and State Park areas and, in making its recommendations, to consider whether the public interest is better served by the development of certain engineering works or by the preservation of existing recreational areas, outstanding natural scenery, and antiquities.

Missouri River Basin.—Funds available during the year were sufficient to permit the expansion of the Missouri Basin program to embrace 12 individual reservoir projects, and two subbasin reconnaissance surveys covering an additional 21 reservoirs. Funds were also assigned to the Smithsonian Institution to speed progress on archeological and paleontological investigations.

Bureau of Reclamation projects.—The report on the comprehensive survey of the recreational resources of the Colorado River Basin, begun in 1941, has been completed and will be published after review by interested agencies.

Seven agreements with the Bureau of Reclamation provide for an advance of funds to the Service for investigation of 128 existing and proposed projects and reservoir sites outside of the Missouri River Basin. Investigation of 62 sites has been made and a number of others are being examined. Archeological and paleontological features are explored and appraised by the Smithsonian Institution with funds transferred by the Service, while biological values of the sites are examined by the Fish and Wildlife Service.

Corps of Engineers projects.—Reports on recreational potentialities and recommendations for their optimum use were completed for 59 additional reservoir sites. The Smithsonian Institution conducted archeological reconnaissance surveys on nine projects and surveys are under way on six others. The Allatoona survey located 206 archeological sites, of which 10 are recommended for partial excavation, 33 others for testing. At the Buggs Island Reservoir in Virginia and North Carolina 94 sites were located. Two of these are extremely important as they appear to represent an eastern phase of the so-called Folsom Culture.

Cooperation with the States.—With most of the State park programs undergoing postwar expansion, the National Park Service was called on frequently to give advice on planning and development, design of structures and facilities, and administrative, maintenance, and operational problems. The Service also compiled two tabulations of State park information.

Advances in historical conservation.—Last December the Adams Mansion at Quincy, Mass., the home of four generations of the Adams family, distinguished in public service, in literature, and in intellectual life, was designated a national historic site and its administration assumed by the Service. The Theodore Roosevelt National Memorial Park, Medora, N. Dak., commemorating the activities of Theodore Roosevelt as frontiersman, rancher, and hunter, was established. Pursuant to the provisions of a 1946 act of Congress, the Philadelphia National Shrines Park Commission, with the assistance of Service personnel, has been making an investigation of Independence Square and its environs, in Philadelphia, to determine whether the area should be recommended for addition to the National Park System. The report of the Commission will be submitted to the Congress on January 3, 1948.

Cabrillo National Monument, closed to visitors during the war, was reopened to the public. Fort Pulaski National Monument, taken over by the Navy during the war, was being returned to the National Park Service at the end of the fiscal year. Fort McHenry National Monument and Historic Shrine, in Baltimore, occupied in part by the Navy during the war, was restored to its prewar condition. Mound City Group National Monument, administered under informal agreement by the Ohio Archeological and Historical Society since 1923, was turned over to National Park Service custody on August 1, 1946.

Fort Frederica National Monument was formerly dedicated on March 22, 1947. Secretary Krug was the speaker for the occasion.

The Jefferson National Expansion Memorial Association at St. Louis, Mo., raised $225,000 for the purpose of holding a Nation-wide competition to obtain appropriate memorial designs that it could recommend to the Department of the Interior for use in the development of Jefferson National Expansion Memorial. Mr. George Howe has been selected as professional adviser to the association, and the first stage of the competition will be completed on October 1, 1947.

The formation of the National Council for Historic Sites and Buildings, and its subsidiary, the National Trust for Historic Preservation in the United States, on April 15, 1947, was a noteworthy event in the field of historical conservation. The Council, consisting of national organizations interested in historical preservations, was established "to further the preservation, study and interpretation, for the public benefit, of historic sites and buildings situated in the United States and its possessions and significant for American history and culture."

Protection progress.—In numerous ways, progress was made in the protection of the historical properties administered by the Service. Use of part of the $200,000 provided for land purchases, mentioned elsewhere, will permit acquisition of certain lands threatened with commercial exploitation. Studies were instituted to determine protective measures needed in areas where public use threatens serious damage to historic structures or prehistoric remains, such as Montezuma Castle. Needed repairs were provided for some of the buildings at Appomattox Court House National Historical Monument. To relieve excessive strain on the building, an additional exit was provided at the home of Franklin D. Roosevelt National Historic Site, and walkways are planned to protect the grounds around the home.

Protection of forests and trees.—During the 1946 calendar year 383 fires either started within or entered park areas, burning 3,731 acres of forest, brush, or grass. Man-caused fires were in a ratio of less than 1 to each 74,000 users; only 380 per million acres of hazardous area were burned. These facts reflect intense prevention, efficient control and public cooperation. The quality of seasonal fire-control personnel improved considerably over that of the war years, predominantly immature and inexperienced. Through Forest Service cooperation, smoke jumpers were used effectively on several fires in remote areas in the northern Rockies, the only region where this activity is carried on.

The care of veteran shade and ornamental trees, particularly in the historic areas administered by the Service, was necessarily neglected during the war. During the past year, a crew of expert tree workers was reestablished and newly equipped. During its period of organization and training it did essential work in eight eastern national cemeteries and historical areas.

Grazing.—With the termination of war emergency grazing permits, grazing within the National Park System has returned to a fairly normal footing. Though the animal unit month total of 110,617 for the calendar year 1946 is greater than that shown for the previous year, that is due to the fact that part of the grazing in Jackson Hole National Monument was not covered by grazing permits until 1946.

Water control projects would affect system.—Emphatic protests have been registered by the Department and by the Service against the construction by the Corps of Engineers of the proposed Mining City Dam on Green River, Ky., at a height that would cause periodic flooding of, and great damage to, Mammoth Cave. The caves and other lands now comprising Mammoth Cave National Park were a gift to the people of the Nation, largely by the State of Kentucky and its citizens. For the Federal Government to damage it through flood-control operations would be a breach of faith with the Congress, which approved park establishment, with the State and citizens of Kentucky, and with the people of the Nation, to whom the park belongs. The Secretary of War has assured the Secretary of the Interior that he will be kept informed regarding the project.

The primitive character of a portion of Glacier National Park is threatened by the proposed construction of a dam at Glacier View on the Flathead River. This proposed dam also would be exceedingly detrimental in its effects on the park wildlife, since the submerged area would encompass practically all of the present winter range of moose, elk, and whitetail deer in this section of the park.

OLYMPIC BOUNDARY QUESTION AGAIN ACUTE

Early in the first session of the Eightieth Congress, the late representative Fred Norman of Washington introduced House Joint Resolution 84, which proposes the establishment of a nine-member commission to study the boundaries of Olympic National Park and to recommend such changes in them as it might consider necessary. This resolution, asserted by some of its advocates to be a democratic approach to a solution of the question, was believed by the National Park Service to be extremely dangerous, since the local interest, rather than the national interest, would be predominantly represented in the membership of the commission, whose recommendations would nevertheless carry great weight with the Congress.

Since it was apparent that some boundary change would be proposed in Congress, the National Park Service, while in no way initiating or pressing the issue, at the request of Representatives Norman and Jackson, prepared for their use a bill defining a boundary along the lines of previous proposals, which would have rectified certain administrative shortcomings in the present boundary, but would have reduced the park by some 56,000 acres and approximately one-seventh of its commercially valuable timber. This bill, introduced as H. R. 2750 and 2751 by the two representatives, provided, as an alternative to the objectionable House Joint Resolution 84, a specific proposal on which public attention could be focused much more readily. This was the result.

It quickly became apparent that the desire of the Olympic Peninsula and Grays Harbor lumber interests went far beyond that proposal. Equally quickly, conservationists and conservation interests throughout the country recorded their united opposition to any change in the boundaries of the park. Hearings are to be held in the Pacific Northwest in September and later in Washington.

ABOLISHMENT OF JACKSON HOLE NATIONAL MONUMENT AGAIN PROPOSED

Representative Barrett of Wyoming, chairman of the House Subcommittee on Public Lands, is again sponsoring legislation (H. R. 1330) to abolish the Jackson Hole National Monument. The Department is opposed to its passage. At hearings held in April, Secretary Krug, in a written statement to the committee, stressed his conviction that the area was fully qualified for the status given it by the late President Roosevelt in 1943, and insisted that no injustice had been done to Jackson Hole stockmen or to owners of land within the monument. He recommended the passage of legislation which would assure protection to Teton County against tax losses in the event any lands were removed from the tax rolls. In addition to his presentation and that of the Director of the National Park Service, a number of conservation groups, in writing or through personal representation, opposed the proposal, though several did suggest some modification of the boundaries.

Representative Barrett's bill, amended to provide for the addition of some 40,000 acres of the monument to Grand Teton National Park, and for transfer of all the rest, amounting to more than 180,000 acres, to Teton National Forest, was favorably reported by the full Public Lands Committee. On the unanimous consent calendar a few days before the end of the session, its passage was objected to by three members; it remains alive, however, and will doubtless come up for action not long after the Congress reconvenes.

Numerous newspaper stories have indicated that the amended bill is a compromise satisfactory to the Department and to those groups which have opposed the abolishment of the monument. On the contrary, it is highly objectionable to all those who value the natural and historic qualities of the present monument area. Much of the land proposed for Forest Service administration is virtually treeless; the entire area east of the Snake River, which offers the most striking view of the Tetons, would be eliminated, as would the fine mountain and lake wilderness north of the Buffalo Fork, and the equally interesting area west and northwest of Jackon Lake.

DISPOSITION OF RECREATIONAL DEMONSTRATION AREAS

Cuivre River, Lake of the Ozarks, and Montserrat Recreational Demonstration Areas were transferred to the State of Missouri for administration as units of its State park system. Pursuant to legislation enacted by the Seventy-ninth Congress, a 5,350-acre portion of Hopewell Village National Historic Site, containing organized group camps and other recreational facilities of local significance, was returned to its previous recreational demonstration area status and then transferred to the Commonwealth of Pennsylvania. Also under legislation enacted by the Seventy-ninth Congress, 14,777 acres of the 20,404-acre Custer area in the Black Hills of South Dakota were added to Wind Cave National Park. The remaining portion will be added to Custer State Park when the South Dakota Legislature enacts appropriate enabling legislation. On June 25, 1947, the President approved a bill (H. R. 2852) which transferred 384.5 acres of excess War Department lands to the Otter Creek area near Louisville, Ky., thus providing a suitable administrative unit totalling 1,768 acres which is acceptable to the city of Louisville. Negotiations for consummating this transfer to the city are being concluded, as are those for the transfer of the Mendocino Woodlands area to the State of California.

Out of the 37 recreational demonstration areas under the administration of the National Park Service on June 6, 1942, 31 and part of another have been transferred to States or localities, or otherwise disposed of. Thus the Service is carrying out its intention to concentrate upon areas that are of distinctly national significance.

FLYING IN AND OVER THE PARKS

In accordance with the previously enunciated policy of the Service, regulations which forbid the landing of planes in any National Park System area, except in emergencies and except at a small number of existing airports and landing strips, were issued by the Department in February, 1947. Though a few editorials in aviation publications or aviation columns of newspapers took issue with the Service's policy, they were more than matched by editorial comment and letters which approved it.

The Service has not been successful in having height limitations established for flights over the parks and monuments. However, experience with the disturbance caused by planes has strengthened the conviction that such flights should be compelled to remain above a reasonable minimum altitude. The Service favors 2,000 feet.

National Park Service field personnel continue to cooperate in the effort to assure satisfactory landing facilities beyond but within reasonable distances of park boundaries.

CONFERENCES BUILD UNDERSTANDING AND MORALE

A National Park Service conference, held at Mammoth Cave National Park last October, was attended by more than 100 employees from field areas, regional offices and the Director's office. The first since 1940, it was spent in intensive discussion of service policies and programs and undoubtedly resulted in much better understanding of them by key personnel of the Service. Perhaps its greatest value was in its heightening of esprit de corps among men who had had to "play a lone hand" during much of the war period. Of great benefit, also, were conferences of chief clerks and of the regional staffs of the Branch of Development, held in the Director's office in Chicago, and in an in-service training conference, for a selected group of Region one field employees, held at regional headquarters in Richmond last January.

Although annual Service-wide conferences are desirable, lack of funds will prevent holding one during the present fiscal year.

THE NATIONAL PARK SYSTEM—PART OF A LARGER WHOLE

The National Park System, conceived and brought into being on an American scale of grandeur, is a part—whose relative importance we shall not attempt to assay—of a vastly larger pattern of parks and recreation areas designed to minister to the leisure time of the American people. Numerous other Federal agencies, almost all of the States, many counties, numerous metropolitan districts, and hundreds of municipalities make their contribution to this pattern. Involved in it are questions of fields of responsibility; of cooperation, and the devising of methods of obtaining it without needless curtailment of authority; of furthering understanding of the necessity of providing both the means by which leisure may be used constructively and the impetus to such use of it.

The National Park Service means to take its fair part in this tremendous and important task; to assume, and to meet as best it may, such responsibilities as are placed upon it.

That assistance has meant, in the case of certain reservoir recreation areas, the undertaking of administration and development; in many more the appraisal of recreational values, and, frequently, the planning of recreational developments. In the newly formed Federal Inter-agency Committee on Recreation, opportunity is afforded for open-minded and candid discussion and the cooperative solution of problems of jurisdiction and responsibility. With the States, it involves a variety of cooperation of which perhaps the most important is that of encouraging the establishment of stable administrative and planning organizations, competent to manage the growing and increasingly useful State park systems and to assist the political subdivisions of the States in the meeting of their responsibilities. The Service does not consider it within its province to engage in the field of community recreation—perhaps the most basically necessary of all; but has consistently urged State agencies to concern themselves with it and to encourage it where such encouragement is needed. The National Park Service is glad to have a part in giving impetus to the State park movement. This work it undertakes without losing sight of its primary function, developing and interpreting the great places of truly national importance in the National Park System.

The values of the national parks are indicated by that gifted writer, Bernard De Voto, in an extraordinarily penetrating article in the June issue of Fortune. He writes:

> Since the people using the parks have leisure and free will, they get in full measure what the parks have to offer. Well, what do they get? What justifies the national parks?

First of all, silence. In any park 3 minutes' walk will permit you to be alone in the primeval, and this single fact is enough to justify the entire National Park System. Moreover, you will enjoy the intimacy of nature as your forefathers knew it. * * * Our civilization excludes steadily increasing numbers of Americans from first-hand knowledge of nature—streams, plants, forests, animals, birds, even the effects of storm—and yet their need of it can never be extinguished. * * *

The national parks preserve not only the organic relationships of nature; they also preserve the extremes of natural spectacle and natural beauty. * * * If the simple experience of uncontaminated nature is inestimably good, so is such an equally simple experience as glimpsing the processes of creation in what the Colorado River and the wind and rain have done at the Grand Canyon—or how a glacier has gutted a peak, how a mountain range has slipped and folded along a fault line, how in the aeons of time the fundamental earth has been erected and then redistributed grain by grain.

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National Park System, travel and area data, June 30, 1947

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1945–June 30, 1946
NATIONAL PARKS				
Acadia	Maine	28, 420. 21	381, 683	31, 424
Big Bend	Texas	691, 338. 95	16, 033	6, 379
Bryce Canyon	Utah	36, 010. 38	132, 461	73, 780
Carlsbad Caverns	New Mexico	45, 526. 59	383, 261	295, 244
Crater Lake	Oregon	160, 290. 33	277, 527	97, 710
Everglades	Florida	270, 720. 00	(1)	(2)
Glacier	Montana	997, 486. 80	210, 735	96, 878
Grand Canyon	Arizona	645, 135. 91	533, 306	333, 969
Grand Teton	Wyoming	94, 892. 92	135, 676	56, 604
Great Smoky Mountains	Tennessee–North Carolina	461, 000. 19	1, 136, 604	945, 468
Hawaii	Territory of Hawaii	173, 404. 60	352, 864	418, 801
Hot Springs	Arkansas	1, 019. 13	293, 706	293, 461
Isle Royale	Michigan	133, 838. 51	6, 802	6, 122
Kings Canyon	California	452, 904. 82	239, 129	135, 183
Lassen Volcanic	do	103, 269. 28	129, 596	53, 752
Mammoth Cave	Kentucky	50, 547. 51	172, 099	104, 237
Mesa Verde	Colorado	51, 017. 87	42, 837	21, 713
Mount McKinley	Alaska	1, 939, 199. 04	1, 557	133
Mount Rainier	Washington	241, 524. 77	971, 052	398, 458
Olympic	do	846, 608. 71	142, 429	116, 624
Platt	Oklahoma	911. 97	468, 203	438, 450
Rocky Mountain	Colorado	252, 626. 19	812, 278	476, 098
Sequoia	California	385, 100. 13	349, 581	227, 211
Shenandoah	Virginia	193, 472. 98	765, 701	690, 413
Wind Cave	South Dakota	26, 573. 62	83, 370	30, 589
Yellowstone	Idaho-Montana-Wyoming	2, 213, 206. 55	827, 032	348, 880
Yosemite	California	756, 440. 62	713, 413	482, 913
Zion	Utah	94, 241. 06	233, 155	137, 987
Total		11, 346, 729. 64	9, 812, 090	6, 318, 481
NATIONAL HISTORICAL PARKS				
Abraham Lincoln	Kentucky	116. 50	52, 564	37, 666
Chalmette	Louisiana	33. 25	73, 740	51, 588
Colonial	Virginia	7, 233. 46	578, 709	378, 158
Morristown	New Jersey	958. 37	284, 716	257, 904
Total		8, 341. 58	989, 729	725, 316
NATIONAL MILITARY PARKS				
Chickamauga and Chattanooga	Georgia-Tennessee	8, 146. 33	240, 057	206, 050
Fort Donelson	Tennessee	102. 54	32, 505	18, 885
Fredericksburg & Spotsylvania	Virginia	2, 420. 71	99, 268	66, 271
Gettysburg	Pennsylvania	2, 463. 46	523, 908	397, 259
Guilford Court House	North Carolina	148. 83	36, 998	30, 098

See footnotes at end of table.

National Park System, travel and area data, June 30, 1947—Continued

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1945–June 30, 1946
NATIONAL MILITARY PARKS—continued				
Kings Mountain	South Carolina	4,012.00	30,859	26,601
Moores Creek	North Carolina	30.00	3,767	4,343
Petersburg	Virginia	1,324.62	110,621	147,413
Shiloh	Tennessee	3,717.59	268,971	157,894
Stones River	do	323.86	22,520	28,143
Vicksburg	Mississippi	1,323.56	25,924	14,654
Total		24,013.50	1,395,398	1,097,61
NATIONAL BATTLEFIELD PARKS				
Richmond	Virginia	684.44	23,725	17,035
NATIONAL MEMORIAL PARKS				
Theodore Roosevelt	North Dakota	27,756.78	(1)	(2)
NATIONAL MONUMENTS				
Ackia Battleground	Mississippi	49.15	(1)	(1)
Andrew Johnson	Tennessee	17.08	23,482	20,500
Appomattox Court House	Virginia	968.25	22,050	12,800
Arches	Utah	33,769.94	3,080	1,371
Aztec Ruins	New Mexico	25.88	11,929	7,154
Badlands	South Dakota	122,972.46	244,691	75,235
Bandelier	New Mexico	27,048.89	22,055	16,538
Big Hole Battlefield	Montana	200.00	2,303	1,770
Black Canyon of the Gunnison	Colorado	13,176.02	18,184	7,599
Cabrillo	California	0.50	[3] 71,365	(1)
Canyon de Chelly	Arizona	83,840.00	2,041	1,299
Capitol Reef	Utah	33,068.74	(1)	(1)
Capulin Mountain	New Mexico	680.42	24,960	16,750
Casa Grande	Arizona	472.50	34,041	24,582
Castillo de San Marcos	Florida	18.51	260,985	260,192
Castle Pinckney	South Carolina	3.50	(1)	(1)
Cedar Breaks	Utah	6,052.20	22,663	18,514
Chaco Canyon	New Mexico	18,039.39	1,337	1,466
Channel Islands	California	1,119.98	(1)	(1)
Chiricahua	Arizona	10,529.80	15,161	8,646
Colorado	Colorado	18,120.55	44,672	25,652
Craters of the Moon	Idaho	47,210.67	21,491	10,639
Custer Battlefield	Montana	765.34	50,706	33,569
Death Valley	California	1,850,565.20	157,303	72,499
Devil Postpile	do	798.46	(1)	(1)
Devils Tower	Wyoming	1,193.91	36,301	16,197
Dinosaur	Colorado-Utah	190,798.49	7,509	5,355
El Morro	New Mexico	240.00	1,899	1,217
Father Millet Cross	New York	0.01	(1)	(1)
Fort Frederica	Georgia	74.53	34,946	4,900
Fort Jefferson	Florida	86.82	8,778	5,588
Fort Laramie	Wyoming	214.41	11,635	7,606
Fort Matanzas	Florida	18.34	13,260	9,156
Fort McHenry	Maryland	47.64	504,242	539,357
Fort Pulaski	Georgia	5,427.39	(4)	(4)
Fossil Cycad	South Dakota	320.00	(1)	(1)
George Washington Birthplace	Virginia	393.68	37,176	23,413
Gila Cliff Dwellings	New Mexico	160.00	(1)	(1)
Glacier Bay	Alaska	2,297,456.27	(1)	(1)
Grand Canyon	Arizona	196,051.00	172	46
Gran Quivira	New Mexico	450.94	2,286	1,131
Great Sand Dunes	Colorado	35,908.19	10,790	6,121
Holy Cross	do	1,392.00	(1)	(1)
Homestead	Nebraska	162.73	1,072	139
Hovenweep	Utah-Colorado	299.34	122	132
Jackson Hole	Wyoming	173,064.62	(1)	(1)
Jewel Cave	South Dakota	1,274.56	10,039	1,748
Joshua Tree	California	655,961.33	47,959	35,040
Katmai	Alaska	2,697,590.00	(1)	(1)
Lava Beds	California	46,027.56	30,737	23,325
Lehman Caves	Nevada	640.00	3,808	2,402
Meriwether Lewis	Tennessee	300.00	12,348	7,552
Montezuma Castle	Arizona	783.09	18,528	11,077
Mound City Group	Ohio	57.00	[5] 20,849	(1)
Muir Woods	California	424.56	277,557	222,471
Natural Bridges	Utah	2,649.70	959	413

See footnotes at end of table.

National Park System, travel and area data, June 30, 1947—Continued

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1945–June 30, 1946
NATIONAL MONUMENTS—con.				
Navajo	Arizona	360.00	368	351
Ocmulgee	Georgia	683.48	28,716	32,196
Old Kasaan	Alaska	38.00	(1)	(1)
Oregon Caves	Oregon	480.00	77,885	29,626
Organ Pipe Cactus	Arizona	328,161.73	77,490	75,484
Perry's Victory	Ohio	14.25	27,500	35,740
Petrified Forest	Arizona	85,303.63	306,576	199,390
Pinnacles	California	12,817.77	17,702	14,097
Pipe Spring	Arizona	40.00	949	1,046
Pipestone	Minnesota	115.60	3,193	3,889
Rainbow Bridge	Utah	160.00	(1)	(1)
Saguaro	Arizona	53,669.24	16,098	15,585
Scotts Bluff	Nebraska	2,196.44	53,642	43,842
Shoshone Cavern	Wyoming	212.37	(4)	(1)
Sitka	Alaska	57.00	1,799	3,987
Statue of Liberty	New York	10.38	543,548	529,140
Sunset Crater	Arizona	3,040.00	11,946	6,773
Timpanogos Cave	Utah	250.00	53,109	40,128
Tonto	Arizona	1,120.00	16,338	11,367
Tumacacori	do	10.00	22,718	17,014
Tuzigoot	do	42.67	12,057	8,708
Verendrye	North Dakota	253.04	(1)	(1)
Walnut Canyon	Arizona	1,641.62	19,179	15,804
Wheeler	Colorado	300.00	(1)	(1)
White Sands	New Mexico	140,247.04	89,493	72,345
Whitman	Washington	45.84	(1)	(1)
Wupatki	Arizona	34,853.03	3,489	2,349
Yucca House	Colorado	9.60	11	47
Zion	Utah	33,920.75	(1)	(1)
Total		9,279,035.02	3,531,277	2,600,069
NATIONAL BATTLEFIELD SITES				
Antietam	Maryland	183.32	31,970	26,056
Brices Cross Roads	Mississippi	1.00	(1)	(1)
Cowpens	South Carolina	1.00	1,217	407
Fort Necessity	Pennsylvania	2.00	76,986	57,968
Kennesaw Mountain	Georgia	60.00	33,295	25,139
Tupelo	Mississippi	1.00	(1)	(1)
White Plains	New York		(1)	(1)
Total		248.32	143,468	109,570
NATIONAL HISTORIC SITES				
Adams Mansion	Massachusetts	4.05	(1)	(2)
Atlanta Campaign Markers	Georgia	20.96	(1)	(1)
Federal Hall Memorial	New York	.49	69,662	68,175
Fort Raleigh	North Carolina	16.45	110,785	24,882
Home of Franklin D. Roosevelt	New York	33.23	486,236	113,772
Hopewell Village	Pennsylvania	848.06	85,801	63,946
Jefferson National Expansion Memorial.	Missouri	82.58	27,801	33,940
Manassas Battlefield Park	Virginia	1,604.57	8,297	7,104
Old Philadelphia Custom House.	Pennsylvania	.79	30,985	27,238
Salem Maritime	Massachusetts	8.61	10,522	6,714
Vanderbilt Mansion	New York	211.65	54,004	26,426
Total		2,831.44	884,093	372,197
NATIONAL MEMORIALS				
House Where Lincoln Died	District of Columbia	.05	63,043	66,226
Kill Devil Hill	North Carolina	314.40	54,649	20,461
Lee Mansion	Virginia	.50	317,991	304,433
Lincoln Memorial	District of Columbia	.61	1,274,967	681,932
Lincoln Museum	do	.18	103,609	106,335
Mount Rushmore	South Dakota	1,686.40	341,298	147,520
New Echota Marker	Georgia	.92	(1)	(1)
Thomas Jefferson	District of Columbia	1.20	589,589	661,508
Washington Monument	do	.37	834,693	751,382
Total		2,004.63	3,579,839	2,739,797

See footnotes at end of table.

National Park System, travel and area data, June 30, 1947—Continued

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1945–June 30, 1946
NATIONAL CEMETERIES				
Antietam	Maryland	11.36	(6)	(6)
Battleground	District of Columbia	1.03	2,700	2,700
Fort Donelson	Tennessee	15.34	(6)	(6)
Fredericksburg	Virginia	12.00	(6)	(6)
Gettysburg	Pennsylvania	15.55	(6)	(6)
Poplar Grove	Virginia	8.72	(6)	(6)
Shiloh	Tennessee	10.25	(6)	(6)
Stones River	do	20.09	(6)	(6)
Vicksburg	Mississippi	119.76	(6)	(6)
Yorktown	Virginia	2.91	(6)	(6)
Total		217.01	2,700	2,700
NATIONAL PARKWAYS				
Blue Ridge	North Carolina-Virginia	38,911.50	1,290,716	683,959
George Washington Memorial	Virginia-Maryland	2,784.76	(1)	(1)
Natchez Trace	Tennessee-Alabama-Mississippi.	13,648.87	(1)	(1)
Total		55,345.13	1,290,716	683,959
NATIONAL CAPITAL PARKS				
National Capital Parks		27,874.78	(1)	(1)
Grand total, National Park System		20,775,082.27	21,653,035	14,666,735
NATIONAL RECREATIONAL AREAS				
Coulee Dam	Washington	98,500.00	(1)	(1)
Lake Mead	Arizona-Nevada	1,680,133.33	1,225,992	992,397
Lake Texoma	Texas-Oklahoma	161,137.00	(1)	(1)
Shasta Lake	California	125,230.00	(1)	(1)
Millerton Lake	do	11,605.00	(1)	(1)
Total		2,076,605.33	1,225,992	992,397
PROJECTS [7]				
Saratoga National Historical Park	New York	1,864.60	47,738	19,243
Kennesaw Mountain National Battlefield Park	Georgia	3,034.21	(6)	(6)
Cape Hatteras national seashore recreational area	North Carolina	74.00	(1)	(1)
Olympic public works project	Washington	43,730.76	(1)	(1)
Total		48,703.57	47,738	19,243 [8]416,459
Grand total, National Park System and other areas and projects under the jurisdiction of National Park Service		22,932,187.71	22,926,675	16,094,834

[1] No travel figures available or maintained.
[2] Not established.
[3] Travel shown from April through June 1947 only.
[4] Closed to public.
[5] Travel shown from Aug. 1, 1946, through June 1947.
[6] Included in travel figures of adjacent battlefield sites, military or historical parks, or memorials.
[7] Includes only those in which lands are under National Park Service administration.
[8] 416,459 visitors to Santa Rosa Island National Monument, which was abolished by act of Congress, July 1946.

Bureau of Indian Affairs

WILLIAM A. BROPHY, COMMISSIONER

THE Bureau of Indian Affairs is charged with the responsibility of so administering the resources held in trust by the United States for Indian tribes and individuals that, through the development of these resources for effective use by the Indians, it may remove itself as trustee and withdraw the public services which it now provides for the Indian population.

Whether this removal and withdrawal will take place at an early or a remote date must depend on a combination of factors, the most decisive of which will be suggested here.

The natural resources remaining in Indian ownership consist principally of some 56 million acres of land in the continental United States. Of this land, 32 milion acres are open grazing land, two-thirds being located in semiarid areas and having low productive capacity; 16 million acres are timber and woodland; 3 million acres are classified as cropland, half of which is irrigated or irrigable. Mineral and petroleum deposits underlie some of the land, but no estimate of the area or value is available. The estimated value of land, timber and improvements is slightly less than $400,000,000.

In their present state of development, use, and ownership distribution, these lands are insufficient in quantity and quality to enable the Indian owners to derive from them a livelihood comparable to that of their rural white neighbors.

The 44,000 Indian families (slightly more than one-half of the Indian population) who derive their income in whole or in part from agriculture, including livestock, obtained in 1946 an income of $40,000,000, or approximately $918 per family. This is gross income, and moreover it includes almost $11,000,000 of farm products consumed in the home. In contrast, the net income of non-Indian farmers reported by the Department of Agriculture for 1945 was $2,541, after the payment of taxes and operating expenses.

Through treaties and agreements, the Indian tribes ceded to the United States almost a billion acres. As part of the general agreement (spelled out differently in different treaties) the Indians retained lands for their own use which were to be inalienable and tax exempt. The Federal Government, under this general agreement, undertook to provide public services such as education, medical care, industrial and agricultural training, etc. The costs of these services have risen with rising costs and with improvements in the services through the years. Today, the Federal Government spends more than $30,000,000 annually in providing these needs.

So long as the agricultural income of Indian farm families, derived from the use of their land, remains at its present low level the Indians will be unable to pay property taxes sufficient in amount to reimburse either the States or the Federal Government for the cost of the services provided. In most cases, moreover, the average value of an Indian farm and household furnishings falls below the homestead exemptions which are allowed in computing the property tax. The only manner by which the Indian population can pay for the public services it now receives is through the development of its resources to their maximum productivity. It follows also that to obtain this maximum income, Indians must use the resources themselves rather than lease them out to non-Indian operators.

Where the resource base is adequate, rapid development and increased income should so improve the economic condition of the affected Indian families as to bring about a reduction of Federal expenditures without throwing an undue burden on States and counties. Some Indian tribes, such as the Menominee, Osage, Klamath, Fort Apache, Flathead, and others to a lesser extent, are already paying all or a considerable part of the costs of administering their reservations.

The problem lies in the extreme poverty of the Indians. At the moment, relatively few tribes could, within any brief period of time, be brought to the position where they could assume any appreciable portion of these costs. The poverty of the Indian people is largely traceable to the fact that during the 50 years preceding 1934 they were induced, often compelled, to dispose of their best lands.

Between 1887 and 1934, Indian land holdings decreased from 138 million acres to 50 million acres, and half of this remainder consisted of poor quality grazing land, on which as much as 45 acres was required to feed 1 cow. Half of the 3 million acres classed as cropland is subject to and requires irrigation, but funds have been made available for the development of only 500,000 acres. Moreover, the Indian owners of this land lacked experience, equipment, and capital for establishing themselves on farms. For similar reasons they were not prepared to exploit their timber resources. Much of the farming and grazing land was leased out and most of the timber was sold on the stump to non-Indian operators and the Indians obtained but a small part of the income which these resources were capable of producing. Except as laborers, the Indians had but a small part in the exploitation of these resources or of the oil and mineral deposits which underlay the land.

Since 1934 when funds became available from various sources for credit operations, for land acquisition, for the construction of additional irrigation facilities, the development of stock-water facilities, range and forest improvements, roads, soil conservation projects, the improvement in the economic condition of many Indians, individually and as tribes, has been remarkable. This progress has demonstrated that wise investment of Federal and tribally owned funds in the development of Indian resources will improve the economic status of the Indians, raise their standards of living, improve their health and bring the population closer to the day when Federal administration can be terminated and Federal services withdrawn.

Investments in the development of Indian resources practically ceased during the war years. They were renewed on a very small scale during the fiscal year 1947, but the amounts made available for the fiscal year beginning July 1, 1947, were barely sufficient to meet maintenance and operation costs.

The improvements resulting from resource development during the past 12 years were especially notable in the field of agriculture and stock raising. This is not surprising in view of the fact that the Indian population is predominantly rural. The 1940 census returns show that only 9 percent of all Indians enumerated were living in urban areas. Even though agricultural extension work among Indians was not organized on a professional level until 1930, and although credit for long-term rehabilitation loans was not available until 1935, the number of beef cattle owned by Indians increased from 170,800 head in 1932 to 382,300 in 1946; dairy cattle during the same period increased from 11,300 to 50,000 head. Income from livestock alone during that period increased from less than $1,300,000 to more than $21,000,000.

This rate of increase is encouraging to contemplate, but the distance still to be covered is reflected by the following facts: Indians owning beef cattle in 1946 number slightly better than 16,500 yet the population of the predominantly grazing reservations amounts to 200,000. Out of 45,000,000 acres of range land (including some lands classed as forest and woodland) Indians are using only 35,000,000 acres. This marginal area, if it could be brought into Indian use, would permit the Indians to increase their livestock holdings by approximately 300,000 head of breeding cows. This stock, on the basis of 60 breeding cows per family, would give an average income of $1,200 to 5,000 families.

A somewhat comparable situation exists with regard to the use of agricultural lands. In 1932 the Indians were reported as using slightly over 500,000 acres in the growing of field crops and gardens. This acreage had increased to about 900,000 acres in 1945, but despite this increase, 1,800,000 acres were still leased to non-Indian operators. The value of sales from crop production in 1946 amounted to $7,688,500, an average of $8.50 per acre. If the same rate of return were realized on the lands in non-Indian use, the Indians would increase their agricultural income by over $15,000,000. On the basis of $1,200 per family, 12,500 additional families would benefit.

Similar parallels could very properly be carried out with respect to the use made of, and income derived from the forests and mineral deposits on Indian lands.

The greatest single factor responsible for increased Indian use of resources is the revolving credit fund authorized by the Indian Reorganization Act (act of June 18, 1934). The first credit appropriation was made July 1, 1935, and appropriations to date amount to a total of $6,600,000. Money repaid into the fund becomes available for further loans. Altogether, $12,927,290, has been loaned in cash since the program was inaugurated. The effectiveness of the program, from a banking point of view, is indicated in the delinquency rate. Of $5,630,937 which was due in 1947, only $18,925.17 was delinquent, or less than 0.3 of 1 percent.

Supplementing these cash loans, the Indian Service has a revolving cattle pool which originated with breeding cows obtained in 1934 and 1935 under the drought-relief program. Altogether, a herd of 42,000 head was obtained and distributed to loan clients, who repaid in kind. Up to the present, a total of 122,750 head has been loaned to Indians.

How the Federal Government may remove itself as trustee over Indian property and how it may discontinue the services which it now provides are questions requiring the most careful examination. With its plenary power in matters affecting the Indians and their property, the Congress could at any moment withhold all appropriations for Indian administration and it could remove all trustee safeguards now in force. Entirely apart from the injustice which such precipitate action would inflict on these first Americans, whose property rights do not derive from any benevolence of the United States, it would prove economically disastrous to reduce the resources available to the Indians.

In testimony before the Senate Civil Service Committee in February 1947, an attempt was made to suggest a fair and equitable basis upon which the Government might measure its responsibility toward a tribe and so determine when it might withdraw as trustee. Four factors were suggested: (1) The degree of assimilation of a tribe, as indicating acceptance by the Indians of white habits and acceptance of the Indians by the white community; (2) economic condition of a tribe, to indicate a reasonable possibility of gaining a livelihood through the use of available resources; (3) willingness of the tribe to dispense with Federal aid and guidance, and (4) willingness and ability of States and communities to provide public services.

The testimony further indicated that, on the suggested basis of judgment, certain tribes and groups were at the point where, at an early date, if not in all cases immediately, Federal supervision could be curtailed or eliminated. For a second list of tribes, a somewhat longer period of adjustment and preparation was indicated. Finally, as to certain tribes and groups, where conditions with respect to all four factors were unfavorable, continued Federal assistance for an indefinite period seemed unavoidable.

Whether these are the proper factors to consider, or whether they are the only factors that need to be considered, is immaterial at the moment. It is certain, however, that only through such a procedure of measuring accomplishments and estimating needs can the Federal Government discharge its responsibility with any degree of satisfaction.

In the report which follows, reference will be made to legislative proposals in the first session of the Eightieth Congress to remove restrictions against the alienation of Indian lands, to make these lands subject to taxation, and to throw the allotted Indians upon their own resources regardless of their readiness for such a move. These proposals have had a disturbing effect. To the extent that they reflect impatience with the rate at which the Government is achieving solutions for the many problems facing the Indian population, they have validity. Granted, perhaps, that the rate of progress has been slow, it nevertheless follows that we get ahead no faster if we reduce our present effort. A hungry and sick Indian is not brought nearer to the day when he may have food and good health if we allow his meager resources to be further diminished or wasted.

Office of the Solicitor

MASTIN G. WHITE, SOLICITOR

CHANGES in the Office.—On July 29, 1946, Mastin G. White took the oath of office as the first Solicitor to be appointed by the President and confirmed by the Senate under the act of June 26, 1946.

In an effort to provide for greater expedition in the handling of the Department's legal work, the Solicitor on September 20, 1946, granted to the chief counsels of the bureaus of the Department extensive authority to act on behalf of the Solicitor. This delegation of authority was clarified and further expanded on February 4, 1947.

Because of unfavorable action by the Congress upon the request of the Solicitor's office for funds to finance its activities during the fiscal year 1948, it was necessary to conduct a reduction-in-force program during the latter part of the fiscal year 1947. The number of employees on active duty was reduced by approximately 35 percent. The branch office which had been maintained for a number of years for the purpose of performing legal services for the agencies of the Department operating in Alaska was closed, and steps were taken to reduce the scope of the services performed by the Office of the Solicitor in Washington.

LEGAL OPINIONS.—As usual, the members of the Solicitor's office devoted a major portion of their time during the fiscal year to the furnishing of legal advice to the administrative officials of the Department. In addition to the oral advice which was given informally from day to day, the office rendered a total of 121 written legal opinions during the course of the fiscal year. The following opinions are mentioned as indicating the types of legal problems submitted to the Office of the Solicitor:

M–34393: Lands on the Huntley Reclamation project, Montana, previously ceded by the Crow Indians cannot be disposed of by the Bureau of Reclamation under the act of May 16, 1930.

M–34459: The Cheyenne and Arapahoe Indians retained no reversionary rights in lands ceded to the United States under the act of March 3, 1891.

M–34516: The Secretary of the Interior may issue oil leases on lands acquired for wildlife refuges.

M–34645: The Secretary of the Interior can make the execution of a "nonstrike" affidavit a prerequisite of continued employment in this Department.

M–34680: Employees of the Alaska Road Commission are entitled to overtime pay under the act of March 28, 1934.

M–34681: The Secretary of the Interior can delegate to the Commissioner of Indian Affairs authority to pass upon ordinances and resolutions adopted by Indian tribes pursuant to constitutions approved or charters issued under the Indian Reorganization Act.

M–34689: The 90-day period within which the President may disapprove a bill which has been passed by the Legislature of Puerto Rico over the veto of the Governor does not begin to run until the bill actually reaches the White House.

M–34695: The statutory authority of the Bureau of Reclamation for the construction of irrigation works is sufficiently broad to authorize preparatory work, such as land leveling, the roughing in of farm distribution systems, and the planting of cover crops, to be done on public lands within an irrigation project.

M–34766: The Taylor Grazing Act authorizes the Secretary of the Interior to fix fees for grazing licenses and permits upon any basis determined by him to be reasonable in the light of the expressed purposes of the act.

M–34836: The order of August 25, 1945, restoring to tribal ownership the surplus lands of the Uintah and Ouray Indian Reservation includes minerals reserved to the United States under patents issued for the surface of the opened lands of the reservation.

M–34840: Funds appropriated for the construction of a reclamation project may be expended to remove from the project site valuable archaeological relics belonging to the Government which would necessarily be lost otherwise as a result of the construction of the project.

M–34893: The Secretary of the Interior may assign to an agency of the Department other than the Bureau of Reclamation the function of marketing electric power generated at reclamation projects.

M–34899: The Oklahoma Community Property Act of 1945 is not applicable to the restricted property of married Indians living in Oklahoma or to the income from such property.

ADMINISTRATIVE APPEALS.—During the fiscal year the Solicitor's office prepared 247 proposed decisions on appeals taken by members of the public to the Secretary of the Interior from the actions of bureau officials. Proposed decisions on 124 motions for rehearing in appeal cases were also prepared. Most of these appeals and motions involved interests claimed in the public lands. Among the more important appeal cases might be mentioned:

Madison v. *Basart* (A–23691), which dealt with the ownership of lands accreted by the Missouri River.

O. O. Cooper (A–24208), which resolved questions of land ownership in an area where the survey upon the basis of which patents had been issued was found to be defective.

United States v. *Cooke* (A–24221), which liberalized the departmental interpretation of the rules pertaining to the final proof which a homestead entryman must offer as to his family's residence during the period of his entry in order to obtain a patent for the land developed by him.

Equity Oil Company (A–24273), which dealt with the problem of how the acreage of a lease is to be charged against the respective statutory allowables of the parties where two or more holders of interests in an oil lease have divided the leasehold among themselves on the basis of horizons rather than on the basis of areal surface.

State of New Mexico (A–24400), which held that under the New Mexico Enabling Act title to school sections within national forests does not vest in the State until the lands are removed from the national forests, although the title had previously vested in the Territory of New Mexico.

Bank of America (A–24427), holding that the alien heirs of a citizen who had applied for an oil and gas lease were ineligible to succeed to the decedent's interest.

CLAIMS.—On August 28, 1946, the Secretary of the Interior delegated to the Solicitor the Secretary's authority to consider and dispose of claims under the provisions of the Federal Tort Claims Act. Subsequently, the general counsel of the Bonneville Power Administration, the chief counsel of the Southwestern Power Administration, the counsel at large in Alaska, the regional counsels of the Bureau of Reclamation, the district counsels of the Bureau of Indian Affairs, and the regional counsels of the National Park Service were authorized to pass upon claims which do not exceed $500 in amount, with the claimants being given a right of appeal to the Solicitor if dissatisfied with the determinations made by field counsel.

This office formulated procedures for the determination and payment of claims in Washington and in the field. A memorandum of instructions with respect to the investigation of incidents which might give rise to a liability on the part of the Government under the Federal Tort Claims Act was prepared.

During the fiscal year a total of 144 claims involving property damages or personal injuries allegedly caused by activities of Interior Department personnel were disposed of by the Solicitor's office.

PATENTS.—A number of formal determinations were made during the year concerning the respective rights of the Government and of employees of this Department in inventions made by the latter while in the service of the Department.

Members of the Solicitor's office represented the Department at a series of interdepartmental conferences on policies and procedures relating to the protection in foreign countries of Government-owned patents.

An effort was made to publicize the availability for licensing of patents controlled by the Secretary of the Interior, through the listing of such patents in the Register of Patents Available for Licensing and Sale appearing in the Official Gazette of the Patent Office.

ADMINISTRATIVE PROCEDURE ACT.—The Solicitor's office conducted a survey with respect to the effect of the Administrative Procedure Act upon the various agencies of the Department, and assisted in revising the regulations and procedures of the Department so that they would be in conformity with the provisions of the act.

This office supervised and coordinated the preparation of statements relative to the organization, procedures, delegations of authority, and sources of information within the Department and its several bureaus, for publication in the Federal Register as required by section 3 of the act.

A file to contain all the opinions and orders issued by the Secretary, the Under Secretary, the Assistant Secretaries, or the Solicitor in the administrative adjudication of cases was established. This file is available for inspection by members of the public during regular office hours.

TITLE MATTERS.—The Solicitor's office rendered 276 title opinions in connection with land transactions of Department agencies during the course of the fiscal year.

LITIGATION.—A number of important court decisions relating to functions or activities of this Department were rendered during the year. One of the most important of these decisions was handed down by the Supreme Court in the case of *United States* v. *California* on June 23, 1947. This case involved the question of the ownership, as between the United States and the State of California, of the soil and minerals beneath the marginal seas adjacent to the California coast, and the decision of the Court was favorable to the Government.

On November 25, 1946, the Supreme Court held in the case of *Alcea Band of Tillamooks* v. *United States* that Indian title based upon the aboriginal occupancy of lands is protected by Federal law, and that the power of Congress to extinguish the Indian title and to take such lands for a public purpose is qualified by a duty to pay fair compensation to the Indians in the event of such taking.

In *Grimes Packing Company* v. *Hynes*, the United States District Court for the Territory of Alaska, Division No. 4, held on July 18, 1946, that the Secretary of the Interior was without authority to include within the boundaries of the Karluk Indian Reservation in Alaska coastal waters adjacent to the upland area of the reservation, and that the Secretary could not restrict fishing in such waters to the Indians of the reservation and other persons obtaining the Indians' consent. An appeal from the decision of the district court was taken to the United States Circuit Court of Appeals for the Ninth Circuit, and the case was pending in that court at the close of the fiscal year.

The United States Circuit Court of Appeals for the Ninth Circuit held on February 11, 1947, in the case of *James Miller et al.* v. *United States* that the occupancy of tidelands by individual Alaskan natives since 1884 vested in such natives rights which entitled them to compensation from the Government when the tidelands were taken for a public use.

March 13, 1947, marked the successful end of the work of the Solicitor's Office in the case of *United States* v. *Santa Fe Railroad*, which established the validity of the aboriginal rights of Indian tribes to lands in the area of the Mexican cession. On that date a consent decree awarding to the Walapai Indians possession of some 502,870 acres of land bordering on the Colorado River was entered.

LEGISLATION.—During the fiscal year the Solicitor's office prepared, rewrote, or reviewed 406 reports to congressional committees upon pending legislation, 90 additional reports to the Bureau of the Budget upon pending legislation, and 118 reports to the Bureau of the Budget on enrolled bills. In addition, the office prepared, revised, or reviewed 35 requests to the Congress for the enactment of legislation.

The following list covers the statutes of major importance to the Department passed during the first session of the Eightieth Congress, including measures which became law after the close of the fiscal year:

Public Law 10: Providing for an emergency well drilling program on the San Carlos Indian irrigation project.

Public Law 12: Providing for the continuation of shipping services to Alaska by the Maritime Commission.

Public Law 38: Establishing the Theodore Roosevelt National Memorial Park.

Public Law 42: Suspending import taxes on copper.

Public Law 74: Providing for the management and disposition of the joint trust funds of the Shoshone and Arapahoe Indians.

Public Law 82: Liberalizing the credits for military and naval service granted to public land applicants.

Public Law 110: Authorizing appropriations for the control of forest pests and diseases.

Public Law 124: Ratifying agreements for the development of helium resources on the Navajo Indian Reservation.

Public Law 152: Quitclaiming to the State of Illinois any interest of the United States in the Illinois and Michigan Canal.

Public Law 184: Extending the duration of the interstate compact for oil and gas conservation.

Public Law 204: Ratifying the trusteeship agreement for the Territory of the Pacific Islands.

Public Law 229: Providing for the reservation of rights-of-way over lands conveyed by the United States in Alaska.

Public Law 239: Providing for the termination of statutes conditioned upon the duration of the war or the national defense emergencies.

Public Law 242: Establishing the Board on Geographic Names.

Public Law 249: Extending the Bankhead-Jones Farm Tenant Act and the Soil Conservation and Domestic Allotment Act to the Virgin Islands.

Public Law 258: Prohibiting the interstate transportation of game fish taken in violation of State or local law.

Public Law 272: Reauthorizing the Gila Reclamation project so as to permit the inclusion of additional lands and an extension of the repayment period.

Public Law 291: Authorizing the disposal of resources on the public domain not otherwise provided for or prohibited by law.

Public Law 328: Implementing the authority of the Bureau of Mines with respect to safety investigations in coal mines.

Public Law 329: Authorizing fisheries investigations in the tropical and subtropical Pacific Ocean.

Public Law 336: Clarifying the restrictions on alienation and tax exemptions applicable to property of Indians of the Five Civilized Tribes.

Public Law 362: Providing for the election of the Governor of Puerto Rico by the people of that island.

Public Law 376: Amending the fee provisions of the Taylor Grazing Act so as to (1) permit allocation of part of the cost of administration to public benefits, (2) establish a separate fee for range improvements, and (3) increase the share of the grazing fee retained by the United States.

Public Law 382: Extending the mineral leasing laws to lands acquired by the United States.

Public Law 385: Authorizing the sale of timber in the Tongass National Forest pending determination of native rights to the proceeds.

MINERAL LEASES.—As a consequence of major changes made by Congress in the Mineral Leasing Act, members of the Solicitor's office collaborated with representatives of the Bureau of Land Management and of the Geological Survey in drafting a revised set of regulations to effectuate the new legislation and to codify the more important of the Department's rulings under the act.

INDIAN DELEGATION ACT.—As part of a program for the decentralization of the work of the Bureau of Indian Affairs, this office helped to work out, under the Indian Delegation Act of August 8, 1946, regulations covering extensive delegations of authority to the Commissioner of Indian Affairs and authorizing subdelegations of authority to field officials of that bureau.

Division of Territories and Island Possessions

EDWIN G. ARNOLD, DIRECTOR

THE United Nations Charter has focused world-wide attention upon non-self-governing territories. The United States, as an administering power, is directed to "develop self-government, to take due account of the political aspirations of the peoples, and to assist them in the progressive development of their free political institutions, according to the particular circumstances of each territory and its peoples and their varying stages of advancement." This directive of the charter is a concise statement of the objectives of the Division now and ever since its creation.

Considerable progress toward these objectives was made during the fiscal year.

Political.—After lengthy hearings by the Committee on Public Lands, the House of Representatives passed House Bill 49, the bill providing for statehood for Hawaii, on June 30, by a vote of 196 to 133. Although the Senate did not act on the bill, it is hoped that favorable action will be taken when Congress reconvenes.

Another notable achievement was the inauguration on September 3, 1946, of Jesús T. Piñero, formerly Resident Commissioner, as the first Puerto Rican Governor in the island's history. The excellent record of Governor Piñero is convincing evidence that Puerto Rican affairs can be competently administered by a noncontinental. The next logical step forward in the direction of full self-government was popular election of the Governor, at least pending congressional authorization of a plebiscite on permanent political status. A bill to authorize popular election of the Governor, beginning with the election of November 1948, was sent to Congress. It also gave the Governor power to appoint the justices of the supreme court of Puerto Rico and all the heads of the executive departments, including the commissioner of education and the attorney general, who have been presidential appointees. Secretary Krug and Governor Piñero, among others, testified in support of the bill. It was passed by the House, by unanimous consent, on June 16, with minor amendments.[1]

At a plebiscite on statehood held in Alaska on October 8, 1946, 60 percent of the voters had indicated a desire for statehood. Hearings were held during April on a statehood bill for Alaska (H. R. 206). The House Public Lands Committee filed no report at the conclusion of the hearings, but made plans for a trip to Alaska during the summer months, after which its recommendations would be submitted to the House.

The Virgin Islands Organic Act reform committee submitted recommendations for revision of the islands' Organic Act, passed by Congress in 1936 to serve as the constitution of the islands. The committee recommended an amendment to permit popular local election of a Resident Commissioner who could bring to Congress an intimate knowledge of the islands' needs and conditions. Although Alaska, Hawaii, and Puerto Rico have long been represented in Congress (by a Delegate or Resident Commissioner who may introduce bills, serve on committees and debate, but may not vote), the Virgin Islands have never been. The Interior Department has publicly favored the proposed amendment and during the past year submitted a bill (H. R. 1553) which would accomplish the desired result, but on which no action was taken.

In 1945, President Truman requested the Secretaries of State, War, Navy and the Interior to make recommendations for the administration of Guam, Samoa, and any other Pacific islands which might be placed under United States administration. The report of the four Secretaries was submitted after the United Nations Security Council approved a trusteeship agreement designating the United States as the administering authority for the former Japanese mandated islands. It recommended that organic legislation for Guam be enacted, to provide civil government and to grant citizenship, a bill of rights and legislative powers to the Guamanians; that similar legislation for American Samoa be submitted to Congress by the Navy and Interior Departments; and that the Navy continue its jurisdiction over Guam and Samoa on an interim basis, pending transfer to a civilian agency at the earliest practicable date as determined by the President. Assuming that Congress approved the trusteeship agreement, military government in the trust territory should be terminated by an Executive order and civil administration on an interim basis should be given to the Navy, with the understanding that an early transfer would be made to a civilian agency. The Department of State undertook to prepare organic legislation for the trusteeship islands.

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[1] The Senate passed it in the closing hours of the session. The Senate version, accepted by the House, provided for a Coordinator of Federal Activities and left authority to appoint the justices of the supreme court with the President. The bill was approved by the President on August 5, 1947, and became Public Law 362, 80th Cong., 1st sess.

At the close of the fiscal year, it appeared certain that the trusteeship agreement would be approved and that the President would issue the Executive order as suggested.[2] Civilian government would come to the islands of the trust territory much more rapidly, it appeared, than in Guam and Samoa, still under naval government after a lapse of 50 years despite the substantial proportion of civilians in their population.

The prospect for self-government in Guam and Samoa looked brighter than ever before, however. The President's committee had suggested submission of organic legislation for Samoa. As early as May, the Congress considered an organic act for Guam. The Secretary of the Interior and the Under Secretary of the Navy urged the House Public Lands subcommittee to approve such legislation and offered a draft of an organic act prepared by their Departments. It was very similar to the organic acts of the other territories, making the Guamanians citizens, authorizing election of a Resident Commissioner, including provision for a bill of rights, giving broad powers to the popularly elected legislature, etc. A presidentially appointed commission would recommend to Congress which of the Federal statutes should be made applicable to Guam. Proceeds of customs duties, income and internal revenue taxes, entry fees, and other Federal taxes levied upon the people of Guam would be covered into the local treasury to help defray local government expenses. The Secretaries recommended that the act go into effect immediately, but that administrative jurisdiction over the island remain with the Navy temporarily, pending transfer to a civilian agency at the earliest practicable date as determined by the President. The subcommittee took the bill and recommendations under advisement. There was some indication that it would prefer to name the civilian agency and prescribe the date for transfer, rather than to leave determination of both to the President's discretion. Enactment of some form of organic legislation would represent a tremendous step forward for the people of Guam, who until now have played little more than an advisory role in their government.

HAWAII

Economic and social Hawaii.—Hawaii, the most economically self-reliant of the territories, prepared to construct hospitals, schools, sewer systems, public buildings, and other public improvements put off during the war.

The Territorial Legislature at its regular biennial session gave

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[2] The agreement was approved, and Executive Order No. 9875 was issued on July 18, 1947.

Hawaii the highest tax schedule in its history; an estimated additional 30,000 Hawaiians would pay income taxes during the coming fiscal year. The new law was expected to bring into the Territorial treasury some $94,000,000 during the next biennium. Other enactments included the creation of an aeronautics commission, with jurisdiction over all territorial airports, airways and navigation facilities; the creation of a soil conservation committee, under a law providing for the organization of soil conservation districts; and passage of a uniform veterans' guardianship act.

Hawaii had many problems to face during the past year. Even though many of the service personnel and Army and Navy civilian employees, who swelled the wartime population and placed such a strain on housing and other community facilities, had left the Territory, the housing shortage continued acute. There had been little civilian construction in Hawaii since the outbreak of the war. Temporary housing was constructed and $5,000,000 was appropriated to convert vacant naval barracks into some 2,000 low-rental housing units, but the only satisfactory solution clearly was construction of permanent homes.

Employment opportunities declined in the more industrial parts of the Territory; during the first 6 months of 1947 unemployment compensation payments increased by more than 400 percent over a similar period in 1946. Since most consumer goods, particularly food items, are brought in from the States, the maritime strikes on the west coast, coupled with strikes at home, put a heavy burden on the territorial economy. During the maritime strike the Division worked with the Maritime Commission and the International Longshoremen's and Warehousemen's Union to obtain ships to transport needed food items to Hawaii and to have them loaded. Cargoes were determined on the basis of lists of essential foods furnished by the Governor's office.

A costly strike, estimated to have resulted in a loss of 180,000 tons of sugar and millions of dollars in wages, began with the expiration of the sugar plantation workers' contract on August 31, and lasted until the second week in November. Under the agreement finally signed by the union and the industry, employees will receive an increase of $10,500,000 annually in wages and other benefits. The pay scale ranges from 70½ cents to $1.38 per hour. The time-honored system of perquisites, under which workers received free housing, fuel, medical care, and other services, has been abandoned; workers now pay rent for their homes under an agreed-upon rental schedule. Medical care, using plantation facilities, is provided through a low-cost group plan, and electricity and water are sold at reasonable rates.

Scheduled air service between San Francisco and Honolulu was inaugurated during the year, and the Civil Aeronautics Board had before it applications for service from the Pacific Northwest directly to Hawaii.

Education standards continued high, although the increased enrollment in the public schools raised the pupil-teacher ratio to 32 to 1 from the previous year's 30 to 1. The Territorial Legislature increased basic compensation of teachers by $45 a month, and authorized payment of a $48 monthly bonus.

Deaths from tuberculosis reached an all-time low, tuberculosis dropping from fourth to fifth place as a cause for death. The ratio was 48.4 deaths per 100,000 population, as compared to 55 per 100,000 during the previous fiscal year. Leprosy, a territorial health problem, also continued its rapid decline.

Land scarcity in Hawaii was increased by the wartime transfer of substantial acreage to military uses. In June of 1946, a land use committee, of territorial officials and representatives of Army and Navy headquarters in Hawaii, was established to review Army and Navy land needs and to return to private or territorial use lands not necessary for defense.

ALASKA

The objective of all Alaskan economic progress has been the development of the Territory and its resources and the encouragement of effective and intelligent settlement. Lack of regular and reasonable freight and passenger transportation can prove not only a most effective deterrent to new development but can destroy what has already been accomplished. Unfortunately, Alaska is peculiarly vulnerable in this field, particularly as to water transportation. Many territorial industries, notably mining and fishing, can be carried on only during the short summer season. Unless equipment and supplies are sent out by boat from Seattle by a certain date, the industry is seriously affected for its entire yearly program. Tie-ups and strikes, both on the west coast and in Alaska, particularly during the spring months, hit the Territory hard. The Division did what it could to see that the strikes were settled promptly, working through the Maritime Commission and the Labor Department's Conciliation Service.

Even more directly related to industrial development, because of its continuing impact, is the rate structure for surface carriers. Freight rates between the States and Alaska, always high, have been directly responsible for the high cost of living in the Territory, for most consumer goods are brought in from the States and freight charges are reflected in the delivered price. Beginning in 1942, the War Shipping Administration and later the Maritime Commission maintained ships in the Alaska service for Government account under general agency agreements with the former private operators. The statutory authorization of the Maritime Commission was due to expire on February 28, 1947. The private operators refused to resume operations for their own account without a rate increase of some 102 percent over 1941 levels, which the territorial economy could not possibly support. Some emergency measure was clearly called for.

The Division, the Maritime Commission, the Alaska Development Board, and the House Merchant Marine and Fisheries Committee concluded that only continuing Government financial aid could insure continued operation, and that Alaska's postwar transportation needs and the revenues required to maintain adequate service could not be determined in less than a year. Accordingly, Congress authorized the Maritime Commission to enter into agreements with the Alaskan carriers until July 1, 1948, under which the Commission would furnish the operators with Government-owned ships at the nominal charter hire of $1 per annum and would assume the cost of requisite marine and war-risk hull insurance. Meantime freight rates, labor costs and other factors would be analyzed so that a permanent solution could be reached by the end of the interim period. Alaska hoped that there would be no further rate increases during the interim operating period, but in May new tariffs calling for increases averaging 65 percent were filed with the Commission. The Commission would not suspend the rates but did set a hearing on them for the fall, as a result of the protests filed with it by the Department of the Interior, the Governor of Alaska, and the Delegate from Alaska. Even with the subsidy and the increased rates, service to Alaska continues poor: passenger accommodations are scarce and service infrequent. Solution for this water transportation problem remains one of the most important questions of the coming fiscal year.

Air transportation made out somewhat better during the year. Northwest Airlines inaugurated regular scheduled service between Seattle and Anchorage in September and between Minneapolis and Anchorage in January. Service by Northwest between the continental United States and the Orient via Anchorage was expected to be inaugurated shortly after the close of the fiscal year. Anchorage, the Territory's largest city, is thus linked to the United States by two carriers, Northwest and Pan American, and is directly on the air route to the Far East. In view of the city's strategic location, a bill authorizing an appropriation for construction of an international airport at Anchorage was introduced in the Eightieth Congress and reported upon favorably by the House Interstate and Foreign Commerce Committee.

The Alaska Railroad also fared well. The Interior Department Appropriation Act for the 1947 fiscal year authorized Federal agencies with surplus supplies and equipment to transfer them to the railroad without reimbursement, upon certification by Interior that they were necessary for maintenance or operation of the railroad. The railroad was thus able to obtain such items as steam and Diesel locomotives, boxcars, gondolas, hospital supplies, steel bridges, mechanical equipment, a power plant and other necessities which could not be obtained in the postwar market at all, or only with difficulty. This enabled the rehabilitation program to progress rapidly. The Interior appropriation bill for the coming fiscal year made a direct appropriation of $4,000,000 and authorized the incurring of obligations and the making of contracts for supplies, equipment, etc., to a total of an additional $15,000,000.

Another requirement for the effective settlement of the Territory is the opening of additional land for homesteading. Previous land withdrawals have been reviewed to determine what areas might be restored for homesteading purposes. At the end of the year, it had been determined shortly to open something over 2,000,000 acres along the Alaska Highway, on which overnight tourist accommodations, service stations, restaurants, etc., may be established, making the highway a more practical artery of commerce into the Territory. A further step in the latter direction was accomplished during May, when the Canadian Government approved a plan under which Dawson Creek, B. C., the southern terminus of the highway, became a customs port of entry, enabling goods to be shipped from the States across Canada by rail for transshipment by truck over the highway at lower rates than would be possible by all-truck shipment across Canada, resulting in lower costs to Alaska consumers and providing an alternative to the water route from Seattle.

Some progress was made toward settling the perplexing problems of native possessory rights to land, which have hindered individual settlement and the building of substantial improvements on property. Hearings on proposed native reservations were held at Barrow and Klukwan and hearings on native claims in other areas were forecast for the summer. Native claims to substantial timber areas in southeastern Alaska have for some time hindered the establishment of a pulp and paper industry there. As a result of negotiations between representatives of the Interior Department, the Indians, and the Department of Agriculture, a bill was drafted to authorize sale of timber and timberlands to private industrialists, the proceeds to be held in escrow in the United States Treasury until the rights of the Indians to the lands and timber sold have been determined by the courts or other competent authority. Under this legislation,[3] the rights of the Indians would be safeguarded without cost to the development of one of

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[3] Signed by the President as Public Law 385, 80th Cong., 1st sess., on August 8.

Alaska's potentially most productive industries and one that will be of great value to the entire United States in restoring depleted stocks of newsprint.

The Territorial department of health, in conjunction with the Alaska Native Service, set up an orthopedic hospital at Sitka, the first of its type that the Territory has had. The Territory acquired a second tuberculosis sanitorium during the year, of great assistance in view of the heavy incidence of the disease in Alaska. The department of health also put into operation a modern clinic on board the ship *Hygiene*, which periodically visits remote and previously inaccessible parts of the Territory. A motor counterpart of the *Hygiene* travels to remote settlements along the Alaska Highway and territorial roads.

PUERTO RICO

In Puerto Rico, economic problems arise chiefly because of the paucity of the island's resources and its geographic location, making it dependent upon importations from the mainland, at high freight charges, which result in correspondingly high consumer costs. The Insular Government and various shipping companies have agreed to a compromise rate increase of 5 to 6 percent instead of the flat 15 percent increase in freight rates originally proposed by the companies, which the Government of Puerto Rico planned to oppose. This increase would not apply to certain commodities vitally needed for the industrial program under either public or private auspices, and as to these items, special promotional rates, some below existing rates, will prevail. Other commodities will be subject either to present rates or to very slight increases. Meantime, the companies and the insular government propose to undertake joint studies with a view to reducing cost factors. They also agreed to discuss proposed rate revisions periodically, to avoid time consuming and expensive hearings before the Maritime Commission. It is believed that this procedure is a practical and unique approach to the freight rate problem.

The insular government several years ago launched an industrialization program, which continued to expand during the fiscal year. To encourage private industry and create new sources of revenue and opportunities for employment, the legislature granted a 7-year tax exemption to "new industries", defined to include many for which Puerto Rico is well suited: pottery; rugs; articles of straw, reed and other fibers; ceramics; cigarettes and cigars; glassware; cardboard and paper pulp; furniture manufacture, and so forth. As of the end of the fiscal year, 14 privately owned plants had been or were in the process of being established under the tax exemption program. The Puerto Rico Industrial Development Company, an agency of the Government of Puerto Rico, was constructing plants for about 7 concerns, estimated to be able to employ about 2,300 workers and carry an annual pay roll of $1,400,000. It had taken preliminary steps toward construction of a 300-room hotel in San Juan to be operated by the Hilton Hotels Corp.; the hotel will ease considerably the shortage of tourist accommodations.

Some of the ambitious undertakings planned had to be curtailed because of a substantial decline in insular revenues. The proceeds of internal revenue taxes collected on products of Puerto Rico are returned to the local treasury, but these proceeds fell off during the fiscal year because of the slowness of the rum market. In the last fiscal year, rum shipments from the island totaled 2,196,146 proof gallons as compared to 3,768,780 proof gallons for the previous fiscal year; internal revenue tax receipts declined during the period from $35,264,371.98 to $19,805,052.07, a drop of 43.84 percent. On the other hand, the income tax receipts collected under insular law totaled $21,592,189.43, an increase of 15.33 percent over the previous year and the highest returns ever recorded in Puerto Rico. Property and excise tax receipts also increased over the previous fiscal year's total.

The Government of Puerto Rico carried out a broad program of social improvements during the fiscal year. Medical care for the indigent and public welfare activities in general increased throughout Puerto Rico, and an educational program on mental hygiene, with special emphasis on problems of the feeble-minded, was inaugurated. The year's mortality rate was the lowest recorded. The death rate from all causes fell from 14.1 per 1,000 in 1946 to 13.2 per 1,000. The school program was expanded, despite the handicap of a continued vacancy in the office of commissioner of education. Approximately $27,000,000 was appropriated for educational activities, the highest figure on record. Total school enrollment as of January 31, 1947, was 404,749, a 6.99 increase over the previous year. Four times as many veterans enrolled in schools and training centers as had enrolled the year before. New classrooms were constructed and farms for agricultural teaching and sites for new school buildings were purchased.

The severe overcrowding in the island has resulted in mass emigration to the mainland, chiefly to the large industrial centers, where many of the migrants soon become relief cases. The insular employment service tripled its placement activities, and cooperated in the selection of Puerto Rican migrant workers for domestic, agricultural and industrial undertakings in the United States. The insular government considered sponsoring migration so that persons could be placed in areas where their skills were needed, or where there was sufficient demand for unskilled labor to absorb them. Investigations were conducted into the possibility of emigration to various South American countries where the climate and living conditions are similar to Puerto Rico's.

VIRGIN ISLANDS

The islands have been in a difficult position economically during the past year. The principal activities have been the growing and processing of sugar cane on St. Croix, and those connected with the harbor at St. Thomas. The Virgin Islands Company, which operates federally owned sugar properties, and employs about 1,000 persons during the sugar season, has in the past been able to carry on the sugar growing and processing operation only with the profits made from making rum with the cane juice. But the condition of the rum market has been such that only a loan from the United States Treasury could keep the company in operation during the next year. Private banks would not accept rum stock as collateral and Government lending agencies could give no assistance for various jurisdictional reasons. It was vitally necessary that the company be kept going, and that it expand its activities during the coming fiscal year. Legislation authorizing the necessary loan was pending before Congress as the year closed.[4]

Additional difficulties were caused by the deactivation of the naval submarine base, which had supplied some employment and brought revenue into the islands through the expenditures of naval personnel and their dependents.

The brightest part of the local scene has been the port of Charlotte Amalie, St. Thomas, which is slowly regaining its former place as the center of transshipment and bunkering activities for the Caribbean. Relaxation of immigration provisions was sought to permit nonimmigrant shipboard passengers to disembark and patronize the Virgin Islands' shops even though not in possession of necessary landing permits. Tourist ships of the Delta and Alcoa Lines are again making the islands a regular port of call on their cruise itineraries.

The Government of the Virgin Islands has tried to encourage construction of large-scale tourist facilities. National Park Service officials advised on the development of beaches and other recreational facilities. The possibilities of operation of various projects by Government Services, Inc., were explored. The Department of Commerce surveyed opportunities for developing industry and agriculture, to broaden the economic base, and escape from the one-crop economy.

The sources of revenue of Virgin Islands Government barely enable it to finance essential governmental activities. Its budget totaled about $1,500,000 for the fiscal year; yet revenues were only about $1,100,000. The difference was made up from surplus funds set aside during the war years, and by a Federal deficit appropriation for the municipality of St. Croix. A study made by the Public Administration Service of Chicago, acting under a congressional directive, reported that revenues of $2,000,000 annually would permit adequate governmental services and government. The Virgin Islands Government has therefore tried to increase revenues from taxation. The local governmental structure was reorganized to prevent duplication of activities. A bill was introduced in Congress [5] which would return to the Virgin Islands treasury the proceeds of internal revenue tax collections.

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[4] Approved by the President as Public Law 268, 80th Cong., 1st sess., on July 30.

Within the limits of its revenues, the local government has made progress in many fields. Sanitary standards in restaurants and other places handling food have been raised by legislative enactments; a modern milk-control law has been passed. The St. Thomas public schools have added a year of kindergarten training. A merit system law has been enacted under which it is planned to establish a local civil service system. The child welfare program under the Federal Social Security Act went into effect in January, under the supervision of trained personnel.

Work was finally begun in mid-January on some of the public works projects appropriated for during the previous fiscal year; bids had been accepted during the summer of 1946, but coal and shipping strikes and shortage of materials on the mainland caused initial construction to be postponed.

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[5] S. 1014. passed by the Senate on July 23, with a ceiling of $500,000 upon the annual return.

Puerto Rico Reconstruction Administration

EDWIN G. ARNOLD, ADMINISTRATOR

OPERATIONS differing little in essentials from those of the previous year have been financed with allotments out of the Puerto Rico revolving fund for projects approved by the President, as follows:

Operation and maintenance of housing projects	$285,000
Management and operation of federally owned lands at Lafayette	11,650
Operation of Castaner Farm project	55,550
Servicing of loans to cooperatives	30,500
General administration	177,050
Operation of central service farms	136,250
Construction of rural houses	154,000
Total	850,000

Receipts from the housing units, including 135 additional rural resettlement dwellings built during the year, exceeded maintenance and operation expense by approximately $115,000. As of June 30, 608 urban and 6,780 rural month-to-month rental agreements had been converted into long-term leases with option to purchase.

As in previous years but on a reduced basis, central service farms continued to assist needy resettlers in the raising, harvesting, and marketing of subsistence crops by furnishing seeds, fertilizer, and expert advice. The Castaner farm produced approximately $1,000 in excess of operating costs from the sale of diversified crops, and continued to furnish employment to members of more than 200 resettled rural families.

Solution of an apparent conflict between the obligations of PRRA-financed cooperatives under their contracts with the Federal Government, and certain terms of a recent insular cooperative reorganization law, as interpreted by some officials of the insular government, is well on the way. The cooperative sugar mills Lafayette and Los Canos ground, respectively, 307,414 and 239,415 tons of cane, producing, respectively, 301,975 and 212,511 bags of sugar of 250 pounds each, an all-time record for both mills. In addition, the subsidiary solvents plant of the Lafayette Cooperative has produced butyl alcohol and acetone to its full capacity in fulfillment of a current contract with British interests. Negotiations for extension of this contract are pending. Not so favorable have been the operating results of the two rug cooperatives, which are being liquidated, or of the citron cooperatives, which must overcome difficulties arising from a reduced demand for its products by Northern manufacturers who have suffered from sugar limitations. Most of the smaller vegetable marketing cooperatives had a reasonably successful year, with estimated sales of approximately $1,000,000.

Board on Geographical Names

MEREDITH F. BURRILL, DIRECTOR

THE Board issued during the year 1,500 decisions, 1,850 additional proposed decisions, procedural directions for 16 areas, systems for writing Arabic, Persian, and Mongolian names in roman letters, and an extensive work on Antarctic names. Preliminary study was made of 22 areas; 120,000 map and text names were edited; and 6,000 name information requests were answered for 140 Government agencies. The master card files and the source materials were augmented at an increasing rate. A beginning was made in codifying policies and procedures to aid in routinizing of procedures.

A most profitable improvement and extension of working relations with comparable foreign agencies was accomplished through participation in the Fourth General Assembly of the Pan American Institute of Geography and History, and through conferences with key people in a number of European countries.

The Special Committee on Antarctic Names recommended 850 names for decision, covering about one-third of those known to have been used or proposed. These were referred to the advisory committee, approved, and promulgated with an explanation of the Antarctic name problem, a statement of policy, and a list of Antarctic expeditions.

Press association stories on recommended names have effectively stimulated local expression of usage and preference, and have extended public understanding of the Board's work and policies.

Advisory committee changes were as follows: a member was appointed from the Central Intelligence Group, the Post Office member died, and the National Geographic Society member resigned.

On July 25, 1947, the President signed Public Law 242, authorizing the functions performed since 1890 under executive orders. The act creates a new Board on Geographic Names that, conjointly with the Secretary of the Interior to whom the staff is directly responsible, is to standardize Federal geographic nomenclature. Representation is specified from the Departments of State, War, Navy, Post Office, Interior, Agriculture and Commerce, the Government Printing Office, and the Library of Congress, and permitted from other agencies as desirable.

Peacetime work for national defense continued to dominate the program since such needs were painfuly evident during the war and since the bulk of the funds were not usable for other work. Discharge of the responsibilities assigned by Public Law 242 will require a more diversified and balanced program.

Division of Budget and Administrative Management

VERNON D. NORTHROP, DIRECTOR

THE Division of Budget and Administrative Management, established by departmental order on December 14, 1943, performs Department-wide staff responsibilities involving the budgetary, financial, and administrative management functions of the bureaus and offices. The Division maintains a working relationship in these fields with the General Accounting Office, the Treasury Department, the Bureau of Budget, and other Government agencies.

Until 1947 activities were confined to the most urgent and immediate problems involved in the handling of the budget responsibilities and, to a limited extent, certain administrative management functions. In 1947 provision was made for the establishment of the finance branch and for increasing the staffs of the budget and administrative management branches. These adjustments in organization and staffing placed the Division in position to carry out the minimum essential functions for which it was created in 1943.

In directing the Department's budget program, the Division establishes general policies, methods and standards to guide the original preparation of budget proposals within the bureaus; reviews and analyzes the programs and budget proposals planned by the bureaus in relation to the over-all budget program of the Department; endeavors to eliminate duplication and inconsistency with other programs; and assists in the presentation of the estimated budget requirements to the Bureau of the Budget and to the Congress.

As a result of continued supervision and coordination of budgetary practices within the several bureaus and offices of the Department, a more unified budget presentation of the Department's needs as a whole has been achieved. During the past year the Bureau of Indian Affairs has operated under a consolidation of appropriations which reduced from 76 to 40 the number of appropriation items for the Bureau, improved and simplified the appropriation structure, and provided funds on a functional basis in accordance with the organization structure of the Bureau. This consolidation of appropriations was made incident to a reorganization of the Bureau which was effected on the basis of a study and recommendations made by this Division. A similar revision of appropriation structure was made during the year in the consolidation of functions of the former General Land Office and the Grazing Service under Reorganization Plan No. 3 of 1946. In addition many improvements have been made both in budget presentation and simplification of appropriation structure for other activities of the Department.

During the past fiscal year, the finance branch has been engaged in establishing a uniform financial-reporting system as required by the regulations of the General Accounting Office, the inauguration of a simplified pay-roll procedure for the bureaus and offices, and the establishment of a centralized control in connection with the retirement fund. In addition, a program is being developed for the conduct of surveys of the accounting and fiscal procedures of bureaus and offices to determine adjustments which may be required to meet departmental standards and requirements.

The administrative planning functions of the Division are exercised through the Branch of Organization and Methods. During the year, the branch has directed the preparation and review of the organizational material submitted by the bureaus and offices for publication in the Federal Register in compliance with the Federal Administrative Procedures Act. This material has been republished along with organization charts and lists of officials as an Official Organization Handbook of the Department.

Reorganization Plan No. 3 under the Reorganization Act of 1945 provided for the merger of the General Land Office and the Grazing Service into the Bureau of Land Management. After a field survey by this Division, a comprehensive report carrying recommendations on the organizational structure of the new Bureau was furnished to the Secretary and the Acting Director of the Bureau.

At the request of the Secretary, the Division conducted an organization survey of the units within the Office of the Secretary and recommended a structure which would simplify the organization by regrouping existing functions so that administrative and program work would be clearly distinguished, and by increasing the emphasis on work of a staff character.

The program characteristics involving the land, water, power, and minerals activities of the Department have been studied in order to improve program classifications for use in program and financial reports.

The Division participates in a wide variety of day-to-day activities, including the review of departmental orders, advice on administrative methods, study of regionalization plans and similar organization and methods problems.

The War Agency Liquidation Branch of the Division was established July 1, 1946, to liquidate war agencies which operated under the Department's jurisdiction. During the fiscal year 1948, the Branch has been responsible for liquidation functions involving the War Relocation Authority, the Solid Fuels Administration for War, the Coal Mines Administration, and the civilian food reserve fund.

Division of Personnel Supervision and Management

MRS. J. ATWOOD MAULDING, DIRECTOR

THE return to peacetime operations has brought a reestablishment of the permanent civil-service procedures and competitive examinations, tighter standards of qualifications and performance, a reduction in the turn-over rate, and a recognition by Executive order of the policy of delegation to operating agencies of personnel matters within the Departments to the extent compatible with provisions of law and efficient administration.

The passage of Public Law 600 on August 2, 1946, permitted practical completion of the delegation of authority to the bureaus to act in personnel matters which has been an objective of the Division of Personnel Supervision and Management. The Division now functions as a staff office with emphasis on the program and policy phases, and as a central clearing house for Department-wide activities.

During the latter part of the fiscal year the Department was struck by an unforeseen and drastic cut in appropriations which resulted in a serious reduction in force. The suddenness of the cut and the uncertainties of the Department's fiscal position as its appropriation bill passed through various stages of the legislative process, the requirements of the Veterans Preference Act, and the difficulties of the retention preference regulations imposed an unprecedented burden upon the Employment Section.

The Department of the Interior has long had the reputation for high morale among its employees. The last few months have seen a definite lowering of this morale occasioned principally by the insecurity of employment. The personnel organizations have a challenging task ahead to bring it back to normal.

The Classification Office in its standards, allocations, and wage administration programs has operated generally in a staff capacity. Considerable guidance and assistance were given to the Bureau of Land Management in effecting its new organization resulting from the President's reorganization which merged the General Land Office and the Grazing Service. That office also took the lead in the study of new organizations in the Geological Survey.

The wage administration program of the Department is in accord with sound labor practices. In general wage rates have continued to advance, particularly in the building trades in which there is still a shortage of labor. Under the policy of paying prevailing rates for similar occupations, wages for ungraded positions in the Department have made parallel advances, with due consideration to the variations involved in Federal employment.

A Department-wide survey as of January 1, 1947, shows that a majority of veterans who have returned with reemployment rights with the Department have received at least a one-grade promotion and in many cases promotions of more than one grade have been given.

The established policy of the Department regarding veterans is to make a positive and concerted effort to reemploy the returning veteran at his maximum capacity, giving him credit for all training and experience acquired both in civilian life and while in the military service.

The training of supervisors is still regarded as of paramount importance and the supervisors' forum has continued in session throughout the year.

At the close of the fiscal year the Department had 52,813 compensated employees, 3,432 in the metropolitan Washington area and 49,381 in the field service. In addition there are 1,526 uncompensated personnel.

Interior Department Museum

H. L. RAUL, MUSEUM CURATOR

THE Interior Department Museum was dedicated on March 8, 1938. For nearly a decade it has served the Department and the public as an educational instrument visualizing and explaining the current aims and activities as well as the almost century-old history of the Department and its important part in the development of the Nation. Its more than 100 display cases exhibit historical material of interest to every citizen of the Republic. The displays reflect American history and the American way of life, which are brought into sharp focus through the visual representation of the wide field of Department activities.

The museum exhibits include paintings of important events in United States history in which the Department has played its part; National Park scenes; Indian exhibits of the past and present, the illustrated story of the old General Land Office, now merged into the Bureau of Land Management; the growth of the public domain; the work of the Geological Survey in land and waters, its aerial survey work, its maps and charts; the mines, their riches and hazards and safety devices; the epochal work of the Bureau of Reclamation. Throughout all the exhibits runs the theme of conservation and the advantages gained by wise investment in the logical development of the national resources.

Here, too, are shown many specimens of the handiwork of the natives of Alaska, Hawaii, Puerto Rico, and the Virgin Islands. Lifelike dioramas dramatize such events as the meeting of Washington and Lafayette at Morristown, N. J., 1780; an old Indian trading post at Fort Union, 1835, and the fur traders of the upper Missouri River; the historic Washburn-Doane Exploration Party in the Yellowstone region, 1870; the great land rush in Oklahoma, 1889; Navajo Indians at their daily tasks; grazing on the public domain; an artesian well; a scene of rescue at a mine disaster; a strikingly impressive dioramic representation of Hoover Dam; a large mural painting of the gigantic Grand Coulee Dam. On display here are original old historic documents; early land grants, land patents, and bounties with the handwriting thereon of men whose names are synonymous with the history of our Nation.

The museum contains many scientific models, illustrations, special charts and maps. Many of the exhibits are extremely rare and unusual.

Attendance and foreign visitors.—Museum visitors during the period in the past year that the museum was open to the public numbered approximately 39,000 persons. Visitors were recorded on the visitors' register from every State in the Union, and from Alaska, Canal Zone, Hawaii, Puerto Rico, and the Virgin Islands. Foreign registrations were from 32 foreign countries.

Special exhibits.—A loan exhibit of much interest was installed in the Indian gallery consisting of a white feathered headdress, chief's fan, ceremonial pipe and beaded tobacco pouch which were presented by the Yakima Council to Secretary Krug on the occasion of ceremonies installing him into tribal membership.

One of the largest coal core specimens ever drilled has been placed in the Bureau of Mines gallery. It is a specimen of banded bituminous coal from the Carboniferous of Ohio, and is 33 inches in diameter and 27 inches in height and weighs 1,200 pounds. This large specimen was obtained from a ventilation shaft drilled for the McLain Fire Brick Co. near Wellsville, Ohio, by the Pennsylvania Drilling Co. of Pittsburgh, Pa., October 1946, and presented to the Bureau of Mines.

Collaboration with bureaus.—Numerous revisions of case exhibits have been made throughout the museum to reflect current activities of the bureaus and further changes are being planned.

A large animated diorama, held for loan exhibit purposes, depicting "The Loop, Alaska Railroad", was forwarded to the Alaska Railroad as a loan exhibit for display in Fairbanks and other places in the territory.

Three hand-colored photographic enlargements of notable scenes in areas administered by the National Park Service have been placed in the museum foyer.

A framed chart in full color showing the "Flags of American Liberty", tracing the history and development of the National flag has been hung in the museum foyer as a loan exhibit from the curator.

Cooperation with other agencies.—Assistance and consultation in display programs and techniques have been rendered upon request to a number of organizations including Bureau of Nutrition, Department of Agriculture; Technical Information, Division of Chaplain Service, United States Army; United States Navy; National Academy of Broadcasting; Utah Centennial Exposition; American Automobile Association; and Pan American Union.

Commander Finn Ronne, United States Naval Reserve, requested and obtained from the museum his carabou parka and polar mittens for use during his current expedition to Antarctica. The apparel had been used formerly by him in the United States Antarctic Expedition, 1939–40 which was conducted by the United States Antarctic Service in cooperation with the Division of Territories and Island Possessions.

Orientation programs.—Museum lecture tours for all new employees have been given under the orientation program instituted by the Division of Personnel Supervision and Management.

School classes or organization groups.—During the year numerous school and college classes have visited the museum. Students and teachers have been supplied with visual and printed material to aid in planning study courses relative to activities administered by the Department. Included among the out-of-town school and teacher groups were a class of 50 students from the Dalton School for Girls, of New York, and a return visit by a Nation-wide group of 80 school teachers attending the institute on the United States in world affairs, conducted under the auspices of American University, who visited the museum in connection with their studies in history, government, and the social sciences.

Permanent collections.—Needed additional space was made available by the opening of an adjoining room which provides air-conditioned live storage and study space for the Gibson collection of Indian materials, the Colburn collection of Indian basketry, and the museum general collection which consists principally of exhibit materials acquired by the former studio of exhibits and later placed in the custody of the museum. The museum laboratory equipment also has been installed in this room.

Publicity.—Publications directed to tourists and other out-of-town visitors are generous in their recognition of the museum as an important point of interest in the Nation's Capital.

Through the courtesy of the Greater National Capital Committee of the Washington Board of Trade, the museum is supplied with their advance lists of all conventions of Nation-wide organizations scheduled to meet in Washington. The Interior Department Museum sends special letters of invitation to visit the museum to the convention delegates, for posting on their bulletin boards during the convention periods.

The above report covers 10 months of the fiscal year. Due to financial adjustments relating to departmental appropriations, it was found necessary to close the museum on May 5 until further notice.[1]

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[1] The museum was reopened on August 5, 1947.

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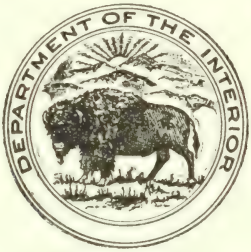
Annual Report of the Secretary of the Interior

Fiscal Year Ended June 30, 1948

Annual Report

OF THE

Secretary of the Interior



Fiscal Year Ended June 30, 1948

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, *Secretary*

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
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THE SECRETARY OF THE INTERIOR
WASHINGTON

My Dear Mr. President: The Annual Report of the Department of the Interior for the Fiscal Year ending June 30, 1948, is herewith transmitted.

As in last year's report, the Department again cautions the Nation against relaxation of efforts to conserve and to husband its natural resources. Much has been done in the field of conservation. Much remains to be done, if we are to retain world leadership.

As the Department of the Interior enters upon the second hundred years of its existence, increasing emphasis will be given to the pressing problems that can arise through unwise use of the resources upon which our prosperity and well-being rest.

Sincerely yours,

J A Krug

Secretary of the Interior.

The President,
The White House.

PART I

Natural Resource Programs

Foreword

EVENTS of the past year have demonstrated that America faces—at best—a period of restless and uncertain peace, constantly harrassed by the possibility of war. Under these circumstances chances for survival rest upon our strength. Our strength in turn, will be measured by natural resources and ability to use them efficiently and wisely.

This will be true, in the long run, whether we have war or peace. Our great industrial machine, the basis of our strength in peace as well as war, cannot function without a steady flow of the greatest stream of power and raw materials the world has ever seen. Two great wars and generations of profligate waste have eaten into our natural resources and begun to exhaust many of them.

We have made America the world's most prosperous Nation despite a reckless use of our natural resources. We have cut over miles of our best forests, without bothering to leave anything for future growth; we have let, and still let, billions of tons of our best top soil wash away to the sea every year; we have mined our more accessible minerals, and abandoned those more difficult to reach. We are today, in the face of an approaching shortage of high grade iron ore, using 14 percent more steel in our automobiles than we did 15 years ago.

As a Nation we are like a young man who inherited such riches he did not think he would ever again have to worry about money. After years of extravagant spending, he suddenly realized his wealth was no longer unlimited—that although he still was richer than most men, he would have to plan the future use of his money if he wanted to continue living well.

America's wealth is measured not in dollars; but in land, water, minerals, and forests. They once seemed inexhaustible. But today we can begin to see the end of many of them, and in some cases it is not far off—at the rate we are using them now. We have reached the point at which if we want to continue living well we will have to plan the future use of our riches.

About 50 years ago we began slowly to try to stop the waste and look ahead a little. Our first concern was our forests—and we took some steps to protect them. But the waste and the use of our forests faster than we replenished them continued, and continues today. It was only 10 or 15 years ago that we began to worry about some of our other great natural resources. Until 1935 we did almost nothing to protect our land—the most basic of all our resources.

Since that time we have made more progress in conserving and developing our natural resources than in all the 150 years previously. Meanwhile, our demands on those resources have multiplied, so that we are continuing to use up some of them faster than we discover or develop new ones. Unless future generations are to face a declining standard of living, we must reverse this process. We must rely more heavily on our inexhaustible supplies, stop the waste of irreplaceable materials, and find and develop additional resources as fast as possible.

Over-all, we still are a rich Nation. Many of our basic resources, are plentiful enough to last us indefinitely. Scarcer ones can be made to last for generations if we use them wisely, substituting more plentiful materials where possible, avoiding waste, and developing additional supplies from natural or synthetic sources.

We cannot do this so long as we select our use of materials on the basis of dollars and cents figuring without counting overhead and other social costs. It was immediate cash profit figuring that led to the tragic waste of our forests, our minerals, and our soils. That was as short-sighted as for a businessman to balance his day-to-day income against his outgo, without allowing anything for overhead, depletion or depreciation. We need to devise a new basis for determining, for example, whether in a given instance we will use oil, or gas, or coal, or water, for energy. We need to take into account all the costs and base our choice, at least to some extent, on future supplies and needs. Some people may object that such a measuring stick would interfere with the American system of free enterprise, but I say they have not thought the matter through. Our American system cannot last indefinitely if we continue to base all decisions on dollar and cents calculations which do not include all of the costs.

As Secretary of the Interior—serving in the Federal Department most directly concerned with preservation and development of our natural resources—I feel a responsibility for trying to inform the American people of the danger they face in the field of natural resources. Part I of this report will deal with some of the more critical fields and conclude with recommendations for action. Further data are contained in the reports of the various agencies of the Department which follow this section.

ANNUAL REPORT OF THE SECRETARY OF THE INTERIOR

Natural Resource Programs

J. A. Krug, *Secretary of the Interior*

Energy

THE use of energy of all kinds is a significant measure of a modern nation's wealth and scale of living. Energy is used to turn the wheels of industry, to heat homes and offices, to provide transportation and communication. It is not used just to supplement manpower but, in fact, to serve as a modern age Paul Bunyan in providing almost 99 percent of what we need to secure the comforts of civilization and the power that protects it.

America is the biggest producer and user of energy in the world. In 1947 it is estimated that we used 45 percent of the energy consumed in the world. Our nearest competitor was Russia, with only 11 percent. We used 40 times as much energy per capita as some other parts of the world and 10 times as much as the average for all the rest of the world.

Until 50 years ago, outside of man and animal power, almost all of our energy came from coal, with a little from waterpower and wood. Today almost half of our tremendous supply of energy comes from oil and natural gas. These two sources now provide us as much as our old stand-by, coal. Waterpower accounts for only about 4 percent. This lavish use of oil is not entirely a result of the development of automobiles and airplanes. Railroad, and space heating, and industrial consumption has enormously expanded.

This amazing record is a demonstration of our skill in developing and using our natural resources. But it does not demonstrate our ability to use our resources wisely. Waterpower—which provides the smallest fraction of our energy—is inexhaustible and we still have a substantial undeveloped potential. We can use it over and over again forever, provided we take the necessary measures to protect our supplies of water. Coal is relatively abundant because of our huge reserves, and yet almost every year we are getting a smaller and smaller percentage of our energy from coal. Oil and gas, which we are using more freely every year, are our most exhaustible and limited sources of energy.

It is a matter of concern to the Nation that oil is the fuel we depend upon to run our automobiles, tractors, our airplanes, and ships. Solid fuel and waterpower cannot be used for most of these vital transport services. The future of transportation—which, in turn, is the basis of modern civilization—rests on the availability of liquid fuel.

Yet in the face of the fact that oil is our scarcest fuel, and the only fuel for many vital uses, we continue to expand our use of it in place of coal and waterpower. Every day more homes are converting from coal to oil heat; more factories are changing over from coal to oil to power their machinery; more electricity is manufactured from oil instead of using coal or waterpower.

This is the result of making our decisions on a narrow dollars and cents basis. Many utility companies which generate electricity use both coal and oil, changing from one to the other, depending upon the current prices. Because of the change of a penny a gallon in the price of oil these huge plants may convert from coal to oil—from our more abundant supply of energy to our limited and precious supply of fuel for transport. Oil is sometimes used even in the manufacture of steel, in the heart of our coal-producing regions.

The potential danger of this situation is not so much the amount of oil we are using unnecessarily now—large as it is—but the amount we soon will be using if the trend continues. Not only are we increasing our total use of energy, but we are increasing the percentage that comes from the scarcest sources.

In 1947 we installed 829,470 new domestic oil-burning furnaces, or a gain of 29 percent over the number in use at the end of 1946. Further installations were made in 1948. There was an equally spectacular gain in the use of oil-burning stoves. Factory shipments in 1947 were nearly double those in 1946. Nearly 25 percent more oil was burned in 1947 than in 1946 for the generation of electric energy. In the first 6 months of 1948 fuel oil consumption at public utility power plants again showed an increase. In 1947–48 we used half again as much oil for heating as 2 years earlier.

If this trend should continue, domestic petroleum supplies may be depleted far more rapidly than otherwise.

Meanwhile use of oil for the purposes for which it is necessary continues to expand. Motor vehicle registrations during 1947 reached an all-time peak of nearly 38,000,000 automobiles, trucks, busses, and motorcycles. This was a gain of 10 percent over 1946. Motor vehicle travel was heavier than in any previous year, and continued to gain in 1948. Agricultural use of gasoline in 1946 doubled the 1941 totals and was even higher in 1947. Aviation gasoline consumption rose a third higher in 1947 than in 1946.

Obviously this trend cannot continue indefinitely unless we rely on foreign oil or develop more domestic sources. In 1947 domestic production of crude oil and gasoline totaled 1,988,797,000 barrels—the highest in our history, but still only about equal to domestic consumption of 1,988,970,000 barrels.

Fortunately, we have many other sources of liquid fuel and other energy that can be developed. Our situation is far from hopeless provided we look ahead and prepare for the future with a broad scale program of conserving our scarce resources and developing those which we are not now utilizing.

The following sections deal with energy resources that come under the jurisdiction—at least in part—of the Interior Department. They do not discuss the possibilities of atomic energy or solar energy—both of which may change the long-range situation, but neither of which can be counted on at this time to provide our necessary motive power for transport in the foreseeable future. In the following sections, various suggestions for conserving our energy supplies and developing new ones will be discussed.

PETROLEUM

As the previous section has indicated, petroleum is our most critical problem in the field of energy resources. Petroleum with natural gas provides almost half our total energy. It powers our great transport system—and for much of that system no other fuel is available. It is the key to our national defense. Nowhere else in the world is there such dependence on oil for economic well-being and national security.

Yet the petroleum situation is not as dark as it often has been painted. While our reserves are limited, and we have used up a large proportion of our original supplies, there are many undeveloped resources from which we can obtain natural or synthetic oil.

Vast oil resources have been found in the Middle East and in South America. American oil companies have played a big part in finding and developing that new supply. It probably would be cheaper in the long run to use some foreign (or imported) oil than to develop some of our own more expensive sources and substitutes.

Unfortunately, we have no assurance of continued world peace. So reliance on foreign sources—particularly sources half way around the world—is dangerous. In time of war our demands for oil to power our ships and planes would multiply. Yet we would have great difficulty curtailing the use of oil in our domestic economy. Any wholesale conversion of industrial and domestic users from oil back to coal would be impractical in an emergency. We would find ourselves in a much tighter spot on oil than in the last war.

When the last war began we had a big developed reserve capacity. Now we have virtually none. Our wells are producing about all they can produce without endangering ultimate recovery. Adequate reserve productive capacity must be restored to protect us in time of emergency—restored either from natural productive capacity or from synthetic sources.

The importance of petroleum to the Nation's security and welfare makes it essential that information as to reserves and availability, domestic and foreign, be as nearly complete as possible, yet there are large areas where adequate information is unavailable. Although progress has been made toward overcoming this condition, such as the Bureau of Mines project for gathering and disseminating petroleum statistics, much remains to be done.

The best estimates we have of proved crude oil reserves—from the industry—place them at about 21,000,000,000 barrels. This, of course, disregards new sources, which have always been found in the past. It is not a reassuring reserve at the rate we are now using oil.

Certainly we are better off than those figures indicate. Most experts believe the industry estimate of proved reserves is conservative. Furthermore, many oil experts believe that we have vast unproven reserves, perhaps as much as four times the proven reserves. Even if this were true, we have only about two generations of domestic crude oil supply left. So far we are continuing to discover new oil as fast, or faster, than we use it. But this is a hazardous base upon which to gamble our future.

True, the Nation has experienced scares over its oil supplies for years and we have not yet run out. The fact remains, however, that the best information in the hands of the Government today does not justify complacency. It is time for us to move with the greatest possible speed to develop alternate supplies. It may take us fully 10 years to develop them sufficiently to keep our automobiles, airplanes, and trains moving in a future continuing emergency, not to mention keeping many factories running.

To a far greater extent than any other Nation the United States is dependent upon oil. Continuation of our present standard of living, our pattern of population distribution, and possibly even of our very existence, presupposes the ready availability of liquid fuels in huge quantities. Yet this imperative need for oil foreshadows continued high demand pressure on domestic reserves and their potential inadequacy long before the much greater reserves of less highly developed areas have been similarly depleted. The obvious implications of this situation emphasize the magnitude and gravity of our oil problem.

There remain great areas in the United States that have not yet been explored completely for oil. New fields or deeper productive horizons continue to be found by more extensive exploration even in areas that have been carefully combed for years. No producing region in the United States has been so thoroughly explored that new deposits may not be found in it.

The finding of new fields has become increasingly difficult and more costly. Somewhere in the future there awaits a peak and then the beginning of declining domestic supplies. There is unquestionably an oil production level beyond which the United States will not be able to go. The change in our oil productive capacity will not be marked with dramatic suddenness.

The gap between our domestic oil supply and our domestic demand for petroleum products, which narrowed to the point at which in 1947 the one equalled the other, again has been broadened. Despite the continuing advances in total United States demand, 5,331,000 barrels daily in 1946; 5,900,000 in 1947; and 6,089,000 in the first nine months of 1948, a substantial improvement in our petroleum supply was achieved in 1948.

The United States now is producing and using substantially more oil than the entire world produced and used in 1938. We are using 600,000 barrels a day more than at the peak of the wartime demand when we had thousands of ships and hundreds of thousands of planes and military vehicles to keep moving, in addition to shipping vast quantities to our allies. On a per capita basis, oil consumption within the United States increased from 368 gallons in 1938 to about 620 gallons in 1948. This is a gain of 68 percent in 10 years.

Much of our additional domestic supply has come from the intensive development drilling and the increase of production-allowables in oil fields which had previously been discovered during the past two decades or more. Additional transportation was provided by putting war-built tankers into service; the addition of pump stations to existing pipe lines; and the ice freeing of important barge-traffic waterways during the winter. Additional refining capacity came from converted or activated war-built units. New facilities accounted only in part for the vastly increased domestic output. A review of the things done during the past 2 years indicates that the relatively easy means of augmenting supply now have been largely utilized. From now on, additions to capacity and supply will call mostly for new work and probably will be more difficult.

As a main objective, the Interior Department has been working to assist the oil industry to enlarge its capacity to produce, transport, and refine oil, and to deliver increasing quantities of petroleum products to the public.

The demand for petroleum according to all indications, will continue upward. That further increases are in the offing appears certain when it is considered that more automobiles will be manufactured; more tractors will be used; more homes will be built and heated with oil; more Diesel-motored facilities will be installed; and there will be expansions in other oil-consuming developments, such as jet propulsion. Two principal items of the anticipated demand increases—Diesel-motor installations and home heating—will call for the production of substantially larger quantities of Diesel and heating oils.

We can look forward to additional oil development, including production, transportation, and refining, in the Eastern Hemisphere. Such development would have the peacetime objectives of largely meeting Eastern Hemisphere demands from local resources, and of making the potential oil resources of the Eastern Hemisphere more accessible to the West. The Western Hemisphere has only half of the proved oil reserves of the world and only a probable one-third of the oil resources which ultimately will be developed throughout the world; yet the Western Hemisphere has been supplying more than 80 percent of the world's oil. This is a relationship which cannot endure too long, or the Western Hemisphere may find itself becoming dependent for oil upon the Eastern Hemisphere.

Although major attention is focused on the development of the great sedimentary basins, such as the Persian Gulf, Caribbean, and our own Gulf Coast, a surprising majority of the nations include within their boundaries sedimentary rocks which offer the possibility of economically-producible oil. Nations having petroleum resources within their borders should have those resources developed, as resource development is the key to social and economic progress. The attainment of local oil production would advance the local economy; reduce the burden of supply put on other areas; lessen the need for ocean hauls; provide a background of oil supply as a measure of security; and bring development which would remain in and be part of the country's assets. An adequate distribution of oil finding is probably as important as the magnitude of the finding.

Conservation at home calls not only for more rational use of our supplies, but for elimination of wastes in production. In some of our important oil States, conservation practices are well behind the advancing technology of oil production engineering. Maximum efficient rates of production are exceeded, vast quantities of natural gas—an invaluable resource in itself and of vital importance in the production of associated liquid petroleum—are blown to the air. Unitization of oil and gas fields, a key to maximum recovery and to operating efficiency lags far behind the needs of the Nation. The States which have not adopted adequate legislation, or do not enforce the legislation they have for the protection of our vital oil resources, must act in the public interest.

We need, also, to develop and to apply the techniques for recovering oil left in the ground in the older fields. We need to spend more money in geologic surveys to find oil and to explore the resources in the sedimentary basin of Arctic Alaska and the submerged lands of the continental shelf off the coasts.

We also need a whole range of measures for development of synthetic oil. Some of the possibilities in this direction will be discussed later.

Natural gas, which is produced along with petroleum as well as separately, is today our third biggest source of energy. It produces more than 13 percent of our total energy, measured in B. t. u.'s. Yet we are allowing about a fifth of our natural gas consumption to escape into thin air every year. This waste—estimated at 873,000,000,000 cubic feet annually—would produce almost a thousand trillion B. t. u.'s, or two-thirds as much electrical energy as all of our water-power sources combined.

We need to study the uses to which we are putting this valuable natural gas. It is an alternative source of liquid fuel. Yet natural gas is being transported in huge quantities to the industrial East for purposes which can be as well served by coal, of which we have much more plentiful supplies.

Industry estimates of proved natural gas reserves place them at somewhere between 166 and 200 trillion cubic feet, or only enough to last 40 years at present rates of consumption. Already our Eastern resources are almost exhausted. Can we afford to use such a limited resource to compete with coal?

OIL UNDER WATER

Estimates of the Nation's petroleum reserves include primarily the oil which has been discovered by drilling on land. In addition, we may reasonably anticipate large oil and natural gas resources under the shallow waters of the surrounding oceans. Oil is now being produced from the submerged lands along our coasts.

Extending outward from our costs is a continental shelf which varies in widths from a few miles to several hundred miles. The total area of the continental shelf, including the part surrounding Alaska, is estimated at almost 760,000 square miles. Most geologists maintain that these areas contain many billions of barrels of oil and trillions of cubic feet of natural gas.

If we have reserves of large magnitude along the continental shelf, it will change our whole petroleum supply situation. But we need to know more about the extent of these resources in order to plan adequately for the future.

The United States Supreme Court has cleared the way for action by a decision holding that title to the oil in the submerged lands off the California coast, belongs to the Federal Government. Until the Court acted, the State had claimed title to the oil and had been leasing it to the oil companies for drilling. The Supreme Court's decision—one of its most important in recent years—turns over to the Federal Government control of the oil in the California submerged lands, and, in effect, presumably along the rest of our coasts.

In view of this decision, and in view of our limited petroleum resources, the Government has a responsibility to act promptly to conserve and develop this resource in the national interest.

The States—particularly Texas—have claimed jurisdiction over vast areas of the continental shelf. Texas has passed legislation including within her border the whole shelf, extending 60 or 70 miles off her coast in the Gulf of Mexico. Legislation is pending in Congress which would give this vast area to the States.

The Interior Department has joined with the Justice Department and the Department of National Defense in opposing this legislation. Instead, the Departments have asked for legislation which would protect the petroleum in the continental shelf as a national asset vital to the security of the Nation. It would authorize the President to withdraw from leasing and reserve for future needs any of the submerged oil deposits that might be required for national defense.

Within recent years, oil companies have paid Texas and Louisiana millions of dollars for leases of this submerged land. Drilling already has started. If the Federal Government is to protect the national interest in this oil, it must move quickly in the courts and in Congress to settle title to the land, and to establish long-range conservation policies.

With the end of our present supply of petroleum almost in sight, the Nation is extremely fortunate to have this new resource. It would be the height of folly to let this rich heritage be used up on the same basis that has wasted so many of our exhausted assets. Nothing short of the national interest should govern the use of this submerged oil.

SYNTHETIC FUELS

Regardless of how much oil is found in the submerged coastal lands, America has one potential liquid fuel resource that could last for hundreds of years. That is synthetic oil. It can be developed from coal, natural gas, or shale. Our resources of shale are almost inexhaustible. Furthermore, our shale is not being used for anything else. From the natural resource standpoint, it is the most logical substitute for our limited supply of petroleum.

It has been estimated we can recover several hundred billion barrels of oil from our vast, unused shale deposits. It may ultimately be cheaper to produce shale oil than petroleum, counting all the increasing costs of new petroleum exploration and production. Our natural gas supplies are almost as short as our petroleum and so gas is not a long-range substitute.

Congress has charged the Bureau of Mines with responsibility for developing oil from coal and shale, the two almost unlimited resources. Research in both fields has reached the point where commercial size plants are needed to continue the progress made in pilot plants. The Department of the Interior recommended during the fiscal year that Congress authorize construction of three commercial size plants for producing oil from shale and coal, two of the plants using different coal processes. Private industry construction and operation was urged for the plants with Government financial assistance to the extent necessary to insure a successful experiment.

The Bureau of Mines' oil-shale demonstration plant near Rifle, Colo., has been in operation for more than a year, producing about 50 barrels of oil a day from shale. By a comparatively simple refining process this oil will yield a fair grade of residual fuel oil. Mining operations in the naval shale reserves at the same place have demonstrated that shale can be mined in large volume mechanically at low unit costs, far below the cost of mining coal. As a result of its pilot plant experience, the Bureau of Mines estimates oil, produced from shale, could be delivered to the large consuming centers for as low as 5.5 cents a gallon.

Further oil-shale research is being conducted by the Bureau of Mines in a laboratory at Laramie, Wyo. Here, among many other experiments with shale and shale oil, tests are being made on shale gasoline and Diesel fuel to determine their characteristics for use in internal-combustion engines.

The Bureau of Mines is experimenting in the production of oil from coal at Louisiana, Mo., and at Bruceton, Pa. A demonstration plant to produce 200 barrels of gasoline a day from coal by hydrogenation is expected to be in operation by next year, at Louisiana. At the same place another plant is under construction to produce 80 to 100 barrels of oil daily by coal gas synthesis. During the past fiscal year the Department dedicated the Bureau's main synthetic liquid fuels laboratories and pilot plants at Bruceton where research in making oil from coal will be centered. Good gasoline—including aviation grades—can be produced from coal, but the cost still is too high to be competitive with natural petroleum, although it is estimated at only a little above 12 cents a gallon. Private industry also is experimenting in the production of oil from coal.

Development of a synthetic liquid fuels industry should be pushed ahead. It may require Government financing, although the capital investment for shale oil is estimated at a lower figure than for new petroleum capacity and although private industry is showing increasing interest in it. But regardless of where the money comes from, the Nation cannot afford to gamble on its supply of liquid fuel, the chief motive power for war, as well as peace. Rapid development of a synthetic liquid fuels industry will safeguard America's future.

Military authorities estimate that another war would require production of tremendous quantities of oil over and beyond present production. A synthetic fuel industry capable of producing a substantial amount of oil could not be built during a war emergency if we start from scratch. It would be a long-range development, and the Department has recommended to Congress that we begin at once to work out the problems of commercial development. Sufficient data has been accumulated by the Bureau of Mines to permit an immediate start which would tremendously speed up expansion in case of an emergency.

If our foreign supply of oil should be shut off by submarine warfare, or enemy control of our foreign oil resources we would face a transportation collapse. A synthetic oil industry capable of filling this gap could not be built as quickly as our synthetic rubber industry was built during the last war unless some commercial production already is under way. We could not convert our millions of oil consuming homes and industries to coal overnight. Our only safe course is to begin at once the building of a synthetic fuel industry.

COAL

Coal still remains our most plentiful source of energy, although it now supplies only half, instead of the 90 percent it used to provide, of our national demand. But it is available to supply a much higher percentage if needed. We have half the known coal reserves of the world. They have been estimated to be sufficient to last several hundred years. These figures, however, include bituminous coal, subbituminous, and lignite. Lignite will be a much higher cost fuel. Our reserves of anthracite are estimated at about 16 billion tons, or enough to last 160 years at present rates of consumption.

Nevertheless, we are using up our richest and most available coal veins, and are running short of certain types, particularly those required for the production of coke for the manufacture of steel. Huge amounts of our metallurgical-grade coking coals were burned during the war and in the post-war high production period. There, conservation is of highest importance to the Nation. Coke plant operators have been forced to look for new sources of coal and devise new methods for washing lower grade coals to make them fit for metallurgical use.

Despite our huge supplies of bituminous coal we cannot afford to waste it. Coal may have to take the place of oil in our scheme of things before many years. It would require a 50 percent increase in coal production to meet a deficiency in petroleum supplies of 2 million barrels a day. In order to save our higher grades of coal for other uses, subbituminous coal and lignite might be used for conversion into oil.

Huge estimates of our coal reserves have created a dangerous complacency about our future fuel supplies. In 1947 we produced 630 million tons of bituminous and lignite, or about as much as in the peak year of 1944. Anthracite production was about 57 million tons. Furthermore, some authorities question the estimates of coal reserves—pointing out the possibility that a large percentage of the reserves may be difficult to mine successfully, and that the amount of coal available for metallurgical use may be comparatively small. We need a reappraisal of our coal reserves, particularly in coking coal.

To obtain the best use of our coal resources we must develop more efficient mining methods, and more efficient burning devices. We must cut the losses in mining operations. The latest survey—25 years ago—indicated that 35 percent of our coal was lost in mining operations. About 60 percent of our coal is now mechanically loaded, but mechanical loading devices cannot discriminate between rock and coal, so much more "dirty coal" is hauled from the mines. Techniques for loading coal have outstripped techniques for cleaning it. Much more research is needed in this field.

It is high time for us to stop using high grade coking coals for other purposes—for which ordinary coal would suffice. Again, this will not be done on the basis of dollars and cents choice. We have the alternatives of continuing to waste our valuable coal reserves on uses of lesser importance to our national economy and security, or of making economic adjustments necessary to limit the use of special purpose coals to special purpose consumption. We also should press our research into the use of lower grade coals.

Further experimentation is warranted on gasification of coal underground—a technique that would make it possible to use great quantities of coal that otherwise will never be mined. Development of this technique would improve materially our long-time fuel supply situation.

WATER POWER

Water power, one of the Nation's oldest sources of energy, remains a minor contributor to our energy supplies, despite all the giant hydroelectric projects built during the past 16 years. It contributed only 4 percent of our total energy from all sources in 1947. But potentially water power is a big factor in our energy supply situation. With proper planning of our future industrial growth it could do much to save our limited oil supplies, as our energy needs expand.

Demand for electricity is growing at a phenomenal pace. Every year we are using more electricity in our homes, on our farms, and in our industries. It turns practically all the wheels in our vast factories. Electricity is one of the principal requirements in the manufacture of aluminum. The development of new electrochemical, electrometallurgical and welding processes is creating greatly increased demand for huge quantities of electricity every year. Production of power was 73 percent higher in fiscal year 1948 than in 1940 and still failed to meet demand.

But most of our electricity is manufactured from our exhaustible fuels such as oil, gas, and coal. Out of 321 billion kilowatt-hours of electricity produced in the United States during the fiscal year 1948 only a little more than 80 billion—or about a quarter—was hydroelectric power, the one kind which is constantly renewed.

Every year we are burning up something like 60 million barrels of precious oil making electricity. More than 100 million tons of coal and almost 500 billion cubic feet of natural gas are consumed the same way.

This use of these limited resources will continue to expand more rapidly than necessary as the demand for electricity mounts, if we fail to expedite development of our water power resources. It is estimated that our demand for electricity will be over 400 billion kilowatt-hours by 1952. If the energy were available, it could go far beyond that. It has been estimated that demand may double in a decade or so. Under present methods, most of this additional power will be made from oil, gas, and coal.

Yet preliminary surveys indicate we have undeveloped hydroelectric power sites capable of producing an estimated 393 billion kilowatt-hours of power a year, or almost five times what we are now getting from water power. That much water power could meet a substantial part of our future energy demand.

No one contends, of course, that water power can meet all our future energy needs, nor even all our future needs for electric power. Not all of the undeveloped hydroelectric sites are located where they are needed most. Two-thirds of them are in the Mountain and Pacific States. But this is the area of the country which is growing fastest and where there is the most room for industrial expansion. Our current energy shortage is most severe in that area.

To the extent that we can develop and use this potential water power we can supply our future energy needs, without exhausting our mineral energy resources. In many parts of the country, particularly the West, water power can be produced instead of using oil, gas, or coal. When we use coal, oil, or gas, we use up our natural resources. When we use water power, we use up none of our resources. Water power can be employed again and again, year after year, without depletion of the supply, provided only that we maintain our water resources by proper conservation measures.

Supplying our future energy needs from water power, instead of from our exhaustible fuels, would contribute to, rather than deplete, our natural resources. Most of our recent dams have added to national wealth in irrigation, flood control, navigation, and other benefits, as well as in power.

If, instead of developing our 393 billion kilowatt-hours of potential power from water, we used oil, it would burn up about a billion barrels of oil a year, or approximately as much as the rest of the world is using for all purposes. If we used coal to get that much power it would burn about 250 million tons of coal a year, or more than a third of our present annual production of coal.

The Nation has an insatiable appetite for electricity. As fast as we have developed hydroelectric and other generating capacity during the war and since, demand has continued to outrun supply. The noncoincident peak demand on all generating plants in 1947 rose 4,382,000 kilowatts over the previous year as compared with an increase in installed capacity of only 2,054,000 kilowatts. This left a reserve of only 1,849,000 kilowatts, or 3.9 percent of the peak demand. This is a dangerously slim margin for electric power, which cannot be stored but must be generated when it is needed.

The crisis was highlighted during the winter of 1947–48 by actual shortages of electric energy in many parts of the country, which forced curtailment of industrial activity and "brown-outs" to save power. Yet despite these efforts to curtail the use of electricity, domestic consumers increased their average annual use to 1,438 kilowatt-hours in 1947, or an increase of 8.2 percent over the previous year. The number of consumers increased from 36,140,291 to 38,431,950, or 6.3 percent; and rural customers 10.2 percent.

In some areas the utilities have been unable to supply the requirements of old customers. This was most serious in the Southwest in the past year. It is also serious in connection with the light metals industry and atomic energy plants which are so dependent upon electricity. Private utilities in the Northwest have urged the Federal

Government to accelerate construction of additional dams on the Columbia River and its tributaries to meet the expanding demand. Military officials also are urging rapid expansion of the Columbia's power facilities as a national defense measure.

Defense authorities have pointed out that we should look to the Pacific Northwest and the Federal low-cost hydroelectric power developments there for much of the future hydroelectric expansion of our aluminum production. Aluminum is being produced now at a rate four times higher than prewar, but the industry estimates output must be increased at least another third to meet peacetime demand. Military estimates are that present production would need to be at least doubled in time of war. Completion of the Pacific Northwest's power projects is the most practical means of increasing the supply of aluminum by means of hydroelectric production.

Government construction of hydroelectric facilities has expanded manyfold during the past 16 years. More than a million and a half kilowatts of capacity have been installed by the Tennessee Valley Authority alone. The Bureau of Reclamation has installed almost 2½ million kilowatts of capacity. But even after this era of great development, total installed water power capacity of the Nation is only 17,000,000 kilowatts. Another 77,000,000 kilowatts remain to be developed. Even at the increased construction rate of the past 16 years it would take another 150 years to make this potential water power available to the public.

The Interior Department, in connection with its reclamation work, has become one of the major agencies of Government for developing hydroelectric power. Since 1933, it has boosted the total capacity of power projects built and operated by the Bureau of Reclamation from 35,300 kilowatts to 2,577,000 kilowatts. The ultimate capacity of these plants, and those under construction or authorized is 5,500,000 kilowatts.

Generation had risen on plants operated by the Bureau from about 154 million kilowatt-hours in 1935 to about 17 billion in 1948. During the war this Reclamation power provided energy for a whole series of new western industries, including the giant magnesium plant near Hoover Dam at Henderson, Nev.; the great airplane factories, steel plants, shipyards, and other industries in southern California; aluminum, airplane, and atomic energy plants in the Pacific Northwest; and many similar developments.

In response to the rapidly mounting demands for western power and irrigation, the Bureau of Reclamation has mapped a 7-year program which, by 1954, would triple its power capacity and produce more than 30 billion kilowatt-hours of energy a year. Congressional appropriations, however, are running somewhat short of this goal.

An even bigger ultimate power capacity will be provided by dams being built by the Corps of Engineers of the Department of the Army, the power from which will be marketed by the Interior Department under existing law.

The Army projects—scheduled and proposed—are designed for an ultimate capacity of 8,508,575 kilowatts, but only 623,400 kilowatts capacity had been constructed by the end of the 1948 fiscal year. Plants with an initial capacity of 1,671,575 kilowatts were under construction.

Selling power both from the Reclamation and the Army projects, the Interior Department has become the marketing agency for the biggest aggregate of hydroelectric power in the world. Through the Bonneville Power Administration it markets the power from the Grand Coulee and Bonneville Dams in the Northwest; it markets power from the Army projects in the Texas-Oklahoma-Arkansas area through the Southwestern Power Administration; and it disposes of power from other Reclamation and Army dams throughout the West through the Bureau of Reclamation.

Power operations of the Department expanded rapidly during the fiscal year 1948. Production of energy for sale totaled 19.6 billion kilowatt-hours, or 20 percent more than the year before. Revenues from power sales were more than $43,000,000. Through its Division of Power, the Department also was negotiating for the future sale of power from eight projects East of the Mississippi under construction by the Corps of Engineers. These plants will have an initial capacity of 645,000 kilowatts.

All of the Department's marketing agencies plan the construction of backbone transmission systems in each area, tying together all the power resources of the area to permit the transferring of blocks of power to suit market conditions. Development of a system of this kind in the Pacific Northwest, with 3,000 miles of transmission lines, has proved an important element in promoting full use of the Columbia River power resources by industry and agriculture. Development of the Missouri Basin project will provide a similar system. Such systems would be impossible under a policy of selling power at the dam, which is advocated by critics of Federal power policy.

In Oregon and Washington, more than $140,000,000 has been invested in plant and equipment for new privately operated factories served by the Bonneville Power Administration. This was a big addition to the tax base of the two States, amounting to about 4 percent of their total taxable property in 1938. By the end of fiscal year 1948, the 10 plants served directly by the Administration had produced more than $700,000,000 worth of aluminum pigs and other products. These companies alone had paid by 1948 more than $50,000,000 in Federal taxes from their profits and more than $3,000,000 in local property taxes.

Industrial development in the Pacific Northwest provides a preview of what may be expected in those parts of the country in which hydroelectric power can be developed in large quantities at competitive costs. Most of the future developments can, however, realize their full potentialities only if they have supplemental steam power. Few rivers have the steady, abundant flow of water that is available in the Columbia. Where the flow of water is irregular, steam plants are valuable sources of supplemental energy to improve the continuity of delivery of power.

Land, Water, Range, and Forests

AMERICA'S greatest natural resources have been its land and its water. From its birth this country has been blessed with both.

But America's rich land resources are wearing out. Many generations of exploitation, of overproduction, of plowing lands that should never have been plowed, of destroying forests, have taken their toll. About 100,000,000 acres of cropland have been ruined, along with millions of acres of forests and livestock range lands. Every year we let enough top soil to provide a normal cover for 500,000 acres wash or blow away. This is the equivalent of land sufficient to feed and clothe 175,000 people. Another 115,000,000 acres will be ruined unless we act quickly within the next few years to save them. This acreage represents a fourth of our present cropland of 460,000,000 acres on which we are dependent for our food and much of our clothing.

Meanwhile, our population is growing. We will have nearly 10,000,000 more people dependent upon our land resources by 1960. The rest of the world can give us little help. Most of it has less acreage per capita than we have. As a result of World War II much of the world is now partially dependent on us for food and clothing.

It is time we stop and plan for our future, and the future of our children. America has used its land resources wastefully. We had so much we gave it away to anyone who would settle on it. We placed no conditions upon its use. Farmers abused the soil and then moved on to new and richer land. We used our forests and our range lands without any thought of the future.

Now we have little additional land that can be cultivated economically. With a growing population, we must get along on what we have, except for the relatively few million acres that can be developed by wise use of our water resources.

We have insufficient water for arid western farm lands and we face increasing difficulty in providing water for some of our heavily populated urban areas. In some parts of the country, notably the Southwest, neighboring States have engaged in bitter battle for the remaining water supplies.

In short, unless we soon rationalize our use of land and water on a much broader national scale than we have in the past, our children's children will have barren wastes in place of some of our present rich cropland. Shortage of water will limit the growth of some of our cities. And silt will too rapidly fill up many of the great power and irrigation reservoirs.

Fortunately we still have enough resources to last, if we use them wisely and well. We have rich deposits of phosphate rock to fertilize worn-out lands. We have enough water in sight to irrigate almost 17,000,000 acres of new wealth-producing farm land. We know what to do to rebuild our forests and ranges to protect and improve our timber and forage resources. In addition, we have the potential industrial power to build all of the huge multipurpose dams we need for the development of our land and water resources.

All we need is an over-all national plan and a public will to do the job.

Within the past 16 years we have laid the pattern. The great power, irrigation, navigation, and flood-control projects in the Tennessee and Columbia River Basins show us the way we must go. We have also undertaken the development of the great Missouri River Basin, the lower Colorado River Valley and the Central Valley of California. But there are more basins that we have barely touched.

Within the past 16 years, too, we have made a beginning on conservation and restoration of our range and crop lands. The beginning has been slow and hesitating. We have not yet caught up with the annual loss of land, to say nothing of turning the tide the other way.

We have made great progress, also, in saving our forests—particularly our publicly owned forests. But we still are using up our valuable timber resources faster than we are replacing them. At our present pace the Nation will have a desperate shortage of saw timber and pulp within a generation or two.

More progress has been made in developing and conserving our water resources within the past 16 years than in all the years prior to that time. But we still have millions of kilowatts of power and acres of productive land to develop. Our power potentialities have been discussed in the previous section on energy. Here they are discussed only in their relationship to our other water and land resources.

Power is the key to the rest of the natural resources development in our big river valleys. Power not only provides energy for homes and factories, but it pumps water onto dry land and provides much of the revenue for irrigation. Just as irrigation needs power, so power sometimes needs to be combined with flood control and navigation, to be economically feasible. Power projects alone do not always produce low-cost electricity. But when the cost of a big multipurpose dam is shared with irrigation, flood control and navigation, the public can get multiple benefits, with reasonably priced power and irrigation.

Furthermore, it is uneconomical to build huge dams to control floods without the many other measures necessary to slow down the flow of water off the land. Without reforestation and revegetation, without storage reservoirs, and soil conservation measures over an entire watershed, the value of the great multipurpose dams is steadily diminished. The various elements of basin development are so completely interdependent that unrelated development of one feature, without the others, may result in a waste of natural resources, instead of a saving.

In the great Colorado River Valley, for instance, a lop-sided development has provided lop-sided, and in some cases only temporary, benefits. Most of the development so far has been in the lower basin resulting from the needs of southern California and Arizona for power and water. In the upper valley huge reserves of phosphate and other precious minerals lie unused because the low cost hydroelectric power needed to produce them has not been made available. It is estimated that the waters of the Colorado and its tributaries can produce 6 million kilowatts of power to vitalize industry and agriculture throughout the entire valley.

In recent years the Bureau of Reclamation has been approaching the problem of western resource development on the basis of broad river basin planning under the authority provided in the Reclamation Project Act of 1939 which authorized construction of multiple-purpose reclamation projects and provided for conservation of the West's limited water resources through coordinated programming and coordinated use. The Bureau was provided with funds for making comprehensive investigations of entire river basins, rather than isolated irrigation projects scattered through the West.

As a result, the Bureau is making comprehensive studies of the western river basins and has now embarked on its share of the development of the potentialities of the Missouri River Basin, the Columbia, the Colorado, and the Central Valley of California. It also has launched a 7-year program of western irrigation and power development which will provide water for 2 million acres of irrigated land, supplement the water supply for three and a half million acres, and triple the Bureau's power capacity.

But the Bureau is only one of many Federal agencies concerned with western resource development. Seven other agencies of the Interior Department—the Bonneville Power Administration, the Fish and Wildlife Service, the Park Service, the Bureau of Indian Affairs, the Geological Survey, the Bureau of Mines, and the Bureau of Land Management—also are involved. So are half a dozen agencies in the Department of Agriculture, the Corps of Engineers of the Department of the Army, and the Federal Power Commission.

These agencies work under separate legislative authority and administrative direction, often with overlapping functions and competing or conflicting objectives. There is no single financial or legislative plan for the river basin development programs. No one agency is responsible for the most effective operation of the multipurpose projects to achieve the maximum effectiveness for all purposes. In the Columbia River Valley, for instance, the planning, construction and operation of projects is divided between the Bureau of Reclamation and the Corps of Engineers, and yet the power from the dams is distributed and marketed by the Bonneville Power Administration. The Federal Power Commission also had a hand in planning the Army projects.

Except in the Tennessee Valley there is no effective administrative mechanism for looking at the Nation's river basin resources and the programs for a region as a whole, for moving all such programs along together on an integrated basis under a single legislative charter, or for the development of related programs such as the encouragement of industrial activity in the basin. Some coordination has been achieved through interagency committees, but these committees have been unable to resolve basic conflicts, often based on conflicting legislation. The individual agencies still make their own decisions under their own legislative mandates.

A much more effective job of regional resource development could be done in the Pacific Northwest where the whole economy of the area is linked to the construction of great multipurpose water control projects in the Columbia Valley. The time has come for the establishment of one agency with responsibility for carrying forward on a unified basis the Government's share of the resource development work in the Columbia Valley.

Most of America's land is now in private hands. The Nation, since its birth, has distributed more than a billion acres of land to private owners. The Government, however, still controls in continental United States about 458,000,000 acres. In addition there is an estimated 365,000,000 acres of public land in Alaska, bringing the total to about 823,000,000 acres. About three-fourths of this is under the jurisdiction of this Department.

Interior is responsible for about 282,000,000 acres in continental United States. Under the Bureau of Land Management are 139,000,000 acres of land in grazing districts; 4,000,000 acres in stock driveways, and 48,000,000 in unappropriated, unreserved public domain. The Bureau of Indian Affairs is responsible for almost 56,000,000 acres of Indian lands; the Bureau of Reclamation for 15,000,000 acres reserved for reclamation developments; the National Park Service for 15,000,000 acres in the national parks; and the Fish and Wildlife Service for 6,000,000 in game and wildlife reserves.

Another 165,000,000 acres of public land in continental United States is under the Agriculture Department of which the United States Forest Service has 158,000,000; and 10,000,000 acres are held by the Military Establishment.

The public land still in the hands of the Government in continental United States, except for the parks and valuable forest land, is mostly land that is uninhabitable. It is a land virtually without people—situated high in the mountains, or in desert areas. But it has a vital part in the preservation of our natural resources. Much of our meat, wool, and leather supplies comes from the public range; some of our best timber comes from the publicly owned forest lands; vast mineral supplies lie under the public domain, some of them almost untouched and unexplored; and our wildlife is protected on the wildlife refuges.

Furthermore, the way we handle this vast area of land will affect our ability to control the waste of soil and water on privately owned land throughout the West. A considerable proportion of our food supply comes from irrigated lands. Our success with them depends to a large extent upon protection of the watersheds, control of erosion, reduction of siltation, and other conservation measures on the public lands.

Various phases of our problems relating to land, water, and forests are discussed at greater length below.

IRRIGATION AND RECLAMATION

The Reclamation program is almost half a century old. Congress authorized it in 1902. But for the first 30 years it was made up chiefly of comparatively small irrigation projects here and there throughout the 17 far Western States, without any over-all development plan. Many of the benefits were dissipated through land speculation; and power development, which now carries much of the load of irrigation costs, was a minor feature.

Up to 1932, when the Reclamation program was 30 years old, 3½ million acres of land were being served by Federal systems, and the total power capacity installed on Reclamation projects was only 106,000 kilowatts. In the drought years of the 1930's the West shriveled and dried up for lack of water during the summers, while in the springs floods damaged huge areas. The shortage of water was so desperate that underground water tables in many areas were pumped down to dangerous levels.

The first approach to multipurpose valley development, in which power revenues would help to finance other benefits, came with the Hoover Dam in the lower Colorado River Basin, begun in 1930's. It was the first Federal dam designed to pay a substantial portion of its cost through power revenue. Its benefits included flood control, power generation, irrigation, municipal water supply, silt removal, navigation, and wildlife refuge. As a single project, it fell far short of the intergrated programs that have been developed since in other valleys.

Hoover Dam has been followed by such bold and broad visioned projects as the Central Valley program in California; the Columbia Basin project in the Northwest; the Colorado-Big Thompson project to divert water across the continental divide to farmlands in northeastern Colorado; the Fort Peck and Shoshone-Riverton-Kendrick-North Platte transmission systems in Wyoming and the great Missouri River Basin project.

By 1942 the Bureau of Reclamation was functioning as the chief single supplier to the West of hydroelectric power and water—the basic needs for hundreds of cities, thousands of war factories, and millions of war workers. The war contribution of new power capacity—1⅓ million kilowatts—constituted 84 percent of the additional capacity made available in the 11 Pacific and Mountain States during the war years.

By the end of fiscal year 1948, the Bureau of Reclamation was supplying irrigation water to more than 5,000,000 acres in the West and the installed power capacity at reclamation projects totalled 2,637,000 kilowatts.

The Missouri Basin project, undertaken jointly by the Bureau of Reclamation and the Army Corps of Engineers, is designed ultimately to irrigate 5,000,000 acres of range and dry lands to stabilize the living of 400,000 families and to provide the opportunity for a good living for more than 200,000 people on 53,000 family sized farms. It will mean a new day for the whole Missouri Valley area, which was hit as hard as any part of the country in the great drought of the 1930's.

It is a peculiarity of the Great Plains in which the Missouri Basin is largely located that a fractional change in the amount of rainfall can bring a flood or a drought. In this it differs, basically, from most of the other valleys such as the Colorado where irrigation is necessary all the time or farmers cannot survive. Dry-land farms in the Missouri Basin pay off in wet years without irrigation, dry up and blow away in drought years. Reclamation is planned to supplement the inadequate normal rainfall, to conserve and store water for use when needed.

This program will eliminate or minimize losses from drought, and stabilize agriculture in the area. The population will be anchored and not find it necessary to move as was necessary in the thirties.

Recognizing that despite the progress, the Reclamation program was inadequate for the needs of the West, the Bureau of Reclamation has, since the war, mapped a 7-year construction program designed by 1954 to add 2 million acres of irrigated land and provide supplemental water to 3½ million additional acres now inadequately served Realization of this program would almost triple the power capacity on Reclamation projects, bringing total capacity up to more than 6 million kilowatts.

Under this program it is estimated that the gross value of all crops grown by farmers on land supplied with irrigation water by the Bureau of Reclamation would increase about $400,000,000 annually. In 1947, the latest year for which complete returns are available, farmers on Reclamation projects reported gross crops valued at $555,000,000. These figures represent the value of crops only and do not include livestock or livestock products, the value of which were estimated at about $150,000,000 more.

The economic benefits from the augmented power under the 7-year program may also be estimated. One yardstick is the translation of hydroelectric power into barrels of oil that would be needed to supply the same energy. The increased power capacity proposed for Reclamation projects would save an estimated 40 million barrels of oil annually. It would mean industrial development for the West several times the recent growth of industry in the Pacific Northwest, provided the same low cost public power policies prevail.

Shortages of power and water have retarded the West's development. The western half of the country today has only a fifth of the Nation's total population; a fourth of its productive farms and a much smaller proportion of its industry. Despite a tremendous natural wealth of land, minerals, and forest, much of the West today remains largely undeveloped and 45 years of construction work by the Bureau of Reclamation and other agencies have barely begun the development of this great potential addition to national strength.

An example of the West's vast natural resources is found in its wealth of minerals. In the 17 Western Reclamation States are huge reserves of industrial fuels such as coal, petroleum, and natural gas, as well as potential metallurgical coke.

Water is the key to the entire development of the West. Basic data gathered by the Geological Survey in planning the 7-year program indicated that the 17 Reclamation States have about 400,000,000 acre-feet of stream run-off annually, only a fifth of which has thus far been put to use. It is clear that a substantial portion of this water is susceptible of development for multipurpose programs. This additional water development would transform millions of acres of land, now largely desert waste, into productive irrigation farms and assure sufficient water for other millions of acres now crippled by short water supply.

This additional area of irrigated land would have a productive capacity two to three times that of dry-farmed land dependent on natural rainfall. These new farm lands could therefore replace all the land in the United States now branded as unsuitable for cultivation—estimated at more than 40,000,000 acres. Farmers now sweating out their energy for inadequate living could raise their families under decent conditions, and the land being used improperly could be turned into forest or range land. In addition, the demand for family size irrigated farms from the increasing population of the West will absorb all the new acreage to be brought under irrigation.

This entire 400 million acre-feet of water also could develop more than 150 billion kilowatt-hours of energy annually—sufficient to supply the needs of New York, Chicago, Los Angeles, Philadelphia, and Detroit, the five largest cities in the United States, and enough to save a third of a billion barrels of oil a year.

The power could be used to pump water onto productive land, to provide water supplies for new cities and augment the supplies for present urban areas, to develop additional ground water supplies, and to provide revenues for the whole natural resource development of the West. It is estimated that on future multiple-purpose projects power must provide the major share of the revenue to repay the power and irrigation portions of the construction costs.

These resource development programs are essential to the realization of the benefits to the Nation of western development. This great region can contribute its full share in the maintenance of a high level of national production only if its undeveloped water resources are unlocked and put to productive use. Slow development for the West means slow development for the Nation.

PUBLIC LANDS

Proper management of the public lands can play a major role in the conservation of our natural resources. Although much of this land was left in Government hands because no one wanted to assume the responsibility of its ownership, it contains valuable forest, range, soil, and mineral resources, and is all-important in the protection and development of the scarce water supply of the West.

Most of the public lands lie where the western rivers originate and where the silt load of the streams can be reduced by protection of the forests and other vegetation. The protective plant cover of this area regulates the silt load in the streams below. As this protective cover is weakened, soil erosion is accelerated on the private lands as well as on the public lands.

Properly handled, the public lands can serve many purposes. They can provide an important part of the forage for our livestock. They can offer a continuing supply of timber. They can make an invaluable contribution to our Nation-wide effort to develop our soil and water resources. And at the same time they can offer recreation for our people, protection for our wildlife, and a possible rich supply of minerals to raise our standard of living.

These are not conflicting goals. They can be achieved simultaneously by adequate coordination of our conservation planning and by the appropriation of sufficient funds to rectify the mistakes of the past. Unfortunately these mistakes of the past were of tremendous scope, because it was not until recent years that the multipurpose value of these lands under public management was recognized.

For more than 100 years the chief function of the Federal Government with reference to the public lands was to act as trustee for the disposal of them to private owners. Much land was transferred to private ownership that would have served the public interest better under multipurpose management by the Government. Little thought was given to the best ultimate use of the land. Huge areas were given away to subsidize construction of wagon roads, railroads, and canals. Later, in the homesteading era which did so much to settle the West, land was given to anyone who would settle on it, with little regard to how well adapted it was for farming. The Interior Department operated primarily as a real estate office.

Ultimate disposal was the only policy of the Government for the public lands. No thought was given to protecting or developing their resources. As a result, huge areas of forest were cut so ruthlessly that their value for future timber supplies and for retarding soil removal was seriously impaired. Range lands were open to the public and over-grazed until they were less useful for forage or for control of the water run-off. Land that should have been left in grass was plowed for crops, contributing to soil erosion.

Even after the conservation movement got started more than half a century ago, it dealt largely with the resources derived from the soil, primarily the forests rather than the basic soil and moisture supply. Few people gave any thought to the soil itself. Only within recent years has there been a widespread awakening to the needs for better care of the soil.

The first organized movement toward conservation of the soil came after 1933 when the Soil Erosion Service was established in the Interior Department. This was followed by the enactment of the Taylor Grazing Act in 1934, and the passage of the Soil Conservation Act in 1935. But it was not until 1940, when President Roosevelt transferred to the Interior Department responsibility for soil and moisture conservation on lands under its jurisdiction that real progress was made on the public domain.

Enactment of the Taylor Grazing Act placed the emphasis on conservation and proper use, rather than neglect and promiscuous disposal of, the public land. Under it, 142,000,000 acres of the public domain eventually were placed under grazing districts with authority for protecting them against overgrazing. The act also made provision for the care and management of the remaining public lands. Additional legislation in 1937, and subsequently, strengthened the management of the forest lands under the Bureau of Land Management of the Interior Department.

Under these various laws, the Department of Interior has made since 1933 more progress in protecting and conserving the natural assets on the public lands under its jurisdiction than had been made in all the history of the country up to that time. Grazing is limited on the public lands, and a start has been made toward repair of past damage to the range. We have launched a program to place most of the timber under sustained yield management. Fire-control facilities have been expanded. Millions of acres have been devoted, at least in part, to conservation of wildlife. And thousands of small dams have been constructed to conserve water supplies.

Of the 282,000,000 acres of land in continental United States under the jurisdiction of the Interior Department, nearly 20,000,000 acres of critically eroded land have been given conservation treatment. Some of this is now permanently protected, but parts of it need further treatment. Conservation measures on this land have included the seeding to permanent vegetation of nearly three-quarters of a million acres; construction of nearly a thousand miles of dikes and levees; the placing of nearly 50,000 small soil-saving dams in gullies; construction of another 17,000 small dams to detain surface water; stabilization of more than a thousand miles of stream banks to save vast areas of bottom land and to decrease siltation in the reservoirs downstream.

But this is only a beginning. Another 40,000,000 to 60,000,000 acres of land are critically eroding. About 47 percent of the 282,000,000 acres under the Interior Department needs early attention to prevent serious or critical erosion. These figures do not include the 343,000,000 acres in Alaska, for which the Department is responsible, because no survey has been made of the situation there.

The 160,000,000 acres of range land under the management of the Interior Department now feed more than 2,000,000 cattle and horses, and 6,500,000 sheep and goats. Our western livestock industry depends to a large extent upon proper conservation and development of this land. America's demand for meat is growing year by year. Fully half the range needs restorative work. Much of it needs to be reseeded, to repair past damage. Altogether 22,000,000 acres of public land need reseeding. Fences need to be erected to control the drift of livestock. Additional water supplies are needed to develop some 15,318,000 acres of unusable range. This area alone would support an estimated 1,000,000 animal unit months of forage. Proper development of the entire range would expand tremendously our meat production capacity.

Protection of the range has been seriously impeded by lack of sufficient appropriations to police it adequately. Records of the Department indicate that during the 1948 fiscal year 57,600 cattle and horses and 87,400 sheep and goats consumed 562,330 animal unit months of forage in trespass operations of the kind which result in overgrazing and serious damage to the range. This amounted to 15 percent of the lawful grazing. Failure to protect the range not only jeopardizes future meat supplies, but increases the cost of meat to consumers. A sharp cut in the funds for policing the range, effective during the previous fiscal year, was partially restored during the fiscal year 1948, but the appropriation still was inadequate.

About 28,000,000 acres of forests and woodlands are under the Interior Department's jurisdiction in continental United States. Under special legislation, the forests on Indian lands have been effectively managed since 1910, but sound policies were not authorized for the other Interior forests until recent years. The commercial forests of the revested railroad lands in western Oregon have been managed properly for only the past 10 years, and sufficient funds have not yet been made available to extend such management to the scattered forests throughout the public domain. For the 120,000,000 acres of forests in Alaska it has not been possible even to maintain adequate fire protection.

There is a large but unknown quantity of mature timber on the public domain which should be cut. It would help to protect the forests, and would supplement our supplies. But lack of funds has prevented even this common sense and economical measure. For the first time in history the Department now has adequate authority to manage its forests properly, but it still has not been given sufficient money for surveying, construction of access roads, or marketing. In fiscal year 1947 only 7 persons could be employed to administer and survey the forests scattered through 20 States.

Legislation to protect the forests from fire started back in 1850. But not until the Civilian Conservation Corps was set up in 1933 was much advance made. Until 10 years ago there was no forest fire control program in Alaska and fire control was seriously inadequate on the public domain forests in the United States. Although adequate funds are not yet available, the loss from fires in public domain forests and grasslands during 1947 was cut to one-half of 1 percent of the area. Yet 598,000 acres of land in grazing districts, having substantial grazing values were burned over. And there still is little protection from fire afforded for some 20 million acres of land outside the grazing districts.

In Alaska the fire story is more serious. During 1947 fire destroyed 1,432,000 acres of forest with an undetermined, but tragic, loss. Much remains to be done to protect the forests both in the United States and Alaska.

Over-all development and conservation of the resources on the public lands is impeded by failure to classify these lands for their best uses. Critical as we are of past generations for their failure to put the public land to its best use, we of this generation have failed in the same direction—until we have completed the job of studying and determining the best use for every acre of public land.

The inadequacy of land classification is one of the great deterrents to putting an appropriate public land policy into action. We need to classify our remaining public land to determine which should be retained by the Government for the public benefit, and which is subject to disposal under the public land laws for cropping, mining, or other specific uses. Such a survey of the 180,000,000 acres of unreserved public land would take 10 years to complete under the most favorable conditions, but could be financed at a cost of only about 4 cents an acre. The Geological Survey is experienced and well equipped to do this job, if funds become available.

The classification would discover and indicate the highest use of the lands; locate some of the mineral resources; find those few areas which are still suitable for homesteading and make them available to settlers; uncover the location of isolated tracts of no use to the government; and indicate the areas that are important for multipurpose use under Government management. Land classification also is the key to an orderly development of the land resources of Alaska, in order to avoid the mistakes we made in land disposal in the States.

There is little excuse for our failure to make the expenditures necessary to develop and protect our public lands, particularly in view of the constant stream of revenue they provide in grazing fees, oil royalties and mineral lease payments.

We have the over-all plans for conservation and development of these public resources. All that is needed is sufficient appropriations to carry them out.

NATIONAL PARKS

The 21,000,000 acres of land including territorial areas in the national park system contain, in addition to their spiritual and recreational values, many of our richest natural resources, including forests, land, water, and wildlife. The objective of the National Park Service is to maintain these areas in their natural state, subject only to the development of facilities so the public can enjoy them.

This objective was carried out prior to World War II. In the years between 1933 and 1940 more progress was made in developing and improving the Nation's parks than in any similar period in American history. Much of this was due to the relief programs, particularly the Public Works Administration and the Civilian Conservation Corps.

The Civilian Conservation Corps built many fire trails and forest fire prevention facilities such as look-out towers and ranger cabins; constructed administrative and utility buildings, sanitation and water systems; did reforestation and soil erosion work; and accomplished many other things for the protection of the parts.

Almost $20,000,000 of PWA funds were allocated for park improvements such as buildings and $34,000,000 for roads and parkways. These funds, plus regular appropriations, permitted the construction or improvement of more than 1,000 miles of park roads and 249 miles of parkways. By 1940 the parks were in better shape than ever before. But during the war, and since, the maintenance of the parks has suffered.

The national park system is threatened today from two different directions. First is the wear and tear as a result of the heaviest public use load they have ever carried, plus the normal wear and tear of nature. The second is the pressure from commercial interests for use of the forest and range lands within the parks that would impair or destroy their value.

The parks are for human use. But to provide for human use without destruction of the qualities that give the parks their essential greatness requires carefully planned development, and sufficient appropriations to safeguard and maintain them. For the past 6 years they have not been kept up because sufficient funds to do so have not been provided. Those units which have come into the system during the past decade are largely lacking in even the most essential developments required for satisfactory use. Existing facilities in the older parks have not been kept in repair, and the facilities in them, which were planned for a much smaller number of visitors, are wholly inadequate to handle the millions of people who are now visiting them.

Throughout the system shortages of physical equipment are matched by shortages of staff. Not only does this mean that the public is not adequately served; but, more seriously, it means that immensely valuable and frequently fragile resources of the parks and historic monuments are damaged by carelessness or vandalism that could be prevented, at least in part, by adequate protection.

Use of the parks has increased tremendously in recent years. The number of visitors to the parks annually has risen from less than half a million in 1917 to more than 25,000,000 in the 1947 travel year, and an estimated 30,000,000 in 1948. Public accommodations are inadequate for this many people; the roads are wearing out; and even the natural beauties of the parks are endangered by lack of maintenance. One of the most serious results of this overuse is the progressive destruction of soil and vegetation which could lead to permanent damage.

Field staffs, particularly in the ranger, naturalist, and maintenance forces, should be increased considerably if natural and historic resources are to be protected adequately without interruption of public use of the parks.

The National Park Service has estimated it would require $395,000,000 over a period of years to meet the needs for conservation and development of the park system to handle the load of visitors now using it. This would cover the cost of roads, trails, parkways, structures, utilities, and other physical improvements. Almost half of this is needed for the road system alone.

By contrast with this, the appropriation for the roads and trails in the parks for the fiscal year 1949 was only $3,110,000 which was not enough to maintain existing roads. Only $735,000 was provided for physical improvements, most of which will have to be spent for repair and rehabilitation that can no longer be deferred. There are actually fewer facilities available in the parks today than in 1941 when the travel load was much lighter.

Commercial threats to the park system include the current attempt to reduce the area of Olympic National Park to make its unique virgin forest available for logging; recent pressure to open the erosion-susceptible mountain meadows of the Sierra parks to grazing; the constant effort of stockmen to open the parks generally to grazing, and their recent move to eliminate all grazing lands from the parks.

Legislation in the Eightieth Congress to reduce the area of Olympic National Park was blocked, but probably will be revived. The Department continues to oppose the proposal to abolish the Jackson Hole National Monument.

The Department also has opposed proposals to flood more than 19,000 acres of scenic wilderness in Glacier National Park by construction of a dam at Glacier View on the North Fork of the Flathead River.

More than 800,000 acres of the park system remain under private ownership, posing another constant threat to the proper maintenance of the areas. The National Park Service cannot control the use or misuse of this section of the parks. It should be purchased by the Government, not only for the sake of the park system but to save rich forest resources.

WILDLIFE

No program for conservation of natural resources would be complete without a well-rounded national effort to protect our wildlife resources, which not only contribute to the pleasure of hunters, but provide furs for warm clothing, and meat and fowl for the table.

Wildlife conservation fits into the whole national resource conservation movement. Wildlife refuges serve many purposes, including conservation of soil and water, as well as other natural assets.

During the past 16 years, huge tracts of Federal land have been set aside as wildlife refuges, and a cooperative Federal-State program for conserving wildlife resources has been established. Only about 16 refuges for waterfowl had been established prior to 1934. Today there are 282 national wildlife refuges in the United States, of which 196, with a total area of 18,107,024 acres are primarily for waterfowl.

In addition to the waterfowl refuges, the Fish and Wildlife Service is now operating 16 big-game refuges and ranges, comprising more than 10,500,000 acres and 25 general wildlife refuges, totaling about 4,000,000 acres. Many of these refuges overlap the national forests and other public domain, and are used for many purposes other than protection of wildlife. Public use of the areas for recreation is encouraged, as long as it does not interfere with wildlife. Even farming is permitted in many areas.

It has been estimated that our national waterfowl resources have a capitalized value of a billion and a half dollars, in addition to the intangible values which are a part of any recreational activity. But these resources have been subject to two attacks—from the ever growing number of hunters, and from the destruction of the natural habitats of the birds as our civilization destroys or transforms more and more of the land and water we inherited from the Indians.

The North American population of ducks and geese probably reached their lowest level in history early in the 1930's. The critical decline in their numbers has been brought about by a combination of natural and man-made conditions—a series of dry years which reduced the suitable nesting areas, ill-planned drainage operations, and excessive hunting.

The population of migratory waterfowl had quadrupled by 1943, as a result of the refuge program, restricted hunting, and favorable weather. But a combination of poor nesting seasons and increased hunting pressure after the war cut this gain in half.

About one-fifth of our total waterfowl population makes use of the refuges established by the Government. It is significant that the refuge populations are remaining fairly stable, and do not reflect the sharp declines periodically seen in the total population. The refuges seem therefore, to be protecting a basic brood stock, which is necessary for repopulating the breeding grounds in the United States, Canada, and Alaska. But although the brood stock is being protected, the present system is not sufficient to protect the level of total population against the hunters, and the drainage and pollution which destroy natural breeding, resting, and feeding grounds. For several years it has been necessary to curtail the length of the open season and reduce the daily bag and possession limits to maintain the balance.

The Fish and Wildlife Service, which conducts this conservation program, has been facing increasing difficulty in enforcing hunting regulations. The number of game management agents has remained fixed at 67 for several years, while the number of waterfowl and other migratory bird hunters has more than doubled. Violations of the conservation laws are increasing, even faster than the number of hunters. More violations of the Migratory Bird Treaty Act and more violations of State game laws were prosecuted during the fiscal year 1948 than in the preceding year.

The number of Federal game law enforcement agents should be increased to insure preservation of our migratory game birds and the future sport of hunting them. Even with inadequate enforcement, however, the reduced take by hunters under the lower legal limits of the 1947–48 season appears to have checked a 3-year decline in the number of waterfowl and enabled a slightly increased number of birds to return to the northern breeding grounds in the spring of 1948.

More is now being accomplished under the joint Federal-State conservation program than at any time since the program was established in 1937 because of increased appropriations starting in the fiscal year 1948. But not enough is yet being done. There are more deer in the United States today than at any previous time, but this increase is poorly distributed. A program of transplanting live animals from one area to another may in the future provide a better distribution.

Fur bearing animals have been grossly neglected in the past. Because of this the United States is producing only about one-half of the furs needed to supply current demand. Yet this is one group of wildlife species that literally is capable of paying its own way if properly managed. In many areas set aside for waterfowl management, the muskrat harvest alone will go a long way toward paying all operating costs. Most marsh areas are only about half productive under present conditions. With sufficient appropriations, proper management could be provided which would result in doubling the annual fur harvest.

It has been demonstrated in the wildlife refuges that properly locater water impoundments are turning relatively worthless land into reservoirs of production. Under multiple use development they are providing habitats for waterfowl and fur bearing animals and at the same time raising and maintaining water tables. In addition, upland game species find drinking water and cover, and fish are usually benefited.

Field borders, windbreaks, and permanent watering places in the wildlife refuges are greatly increasing the game-carrying capacity of the land and at the same time protecting it from erosion and abusive farm practices. Every year there is increased planting of lespedezas and multiflora rose on the wildlife projects. Twenty-three States now have restoration projects under the joint Federal-State program.

During the past year the Fish and Wildlife Service gave more protection from depredations of harmful animals than ever before in history. More than half the coyotes caught last year were taken with coyote-getters, a device developed by a former employee of the Service, and 25 airplanes were used in hunting this destroyer of farm animals.

The Service also was active in control of rats and other rodents. During the latter part of the year, the Department sponsored a national rat control campaign which attained the first coordinated Nation-wide drive on rats. For the first time, 580 American cities acted with 879 counties to control rat infestation simultaneously.

With 12,000,000 hunting licenses issued during the year, and the number of game hunters growing annually, the work of preserving our wildlife resources must be intensified if future hunters are to have adequate opportunity.

INDIAN RESOURCES

The Nation's Indians are poor because much of their land is poor. Yet some of the Nation's most valuable natural resources, including forests, grazing land, and minerals, are on the 56,000,000 acres of land owned by Indian tribes and individuals. These resources if properly developed can contribute far more than they have in past years not only to the Indians but to the Nation as a whole.

Indian resources include 3,000,000 acres of agricultural land, 16,000,000 acres of forest, and 32,000,000 acres of grazing land, as well as a wide diversity of minerals. Development of these natural resources is tied into the problem of developing the human resources of the Indian people, for without health or education the Indian has neither the will nor the ability to make the best use of his assets.

In the past the Indians have leased most of their best crop and grazing land to non-Indians instead of operating these areas themselves. This not only was bad for the Indians but bad for the land.

Some of the most serious soil depletion has occurred on farm lands leased by the Indians to white lessees on insecure tenure, which did not encourage proper maintenance of the soil.

Much has been done within the past 16 years to develop the resources of the Indians and to help them to make the best use of their natural assets. Some of this improvement has been based on agricultural extension work, which was made available among the Indians for the first time in 1930. The first objective of that program was to encourage the Indians to use their own land and resources instead of leasing them. This program really became effective after enactment of the Indian Reorganization Act of 1934, which provided more adequate credit facilities for the Indians.

Since that time the Indians have increased the acreage of cropland they farm themselves by 400,000 acres and have taken over the operation of more than 7,000,000 acres of grazing land. Indian-owned livestock has increased from 171,000 head in 1932 to 361,000 in 1947. Total agricultural income of Indians has risen from $1,850,000 in 1932 to almost $49,000,000 in 1947, which included $12,000,000 worth of farm products consumed at home. It is conservatively estimated that more than 12,000 families have been completely or partially rehabilitated and are now self-supporting, or nearly so. Yet too much Indian land still is leased to others.

Resource development during this period included the construction and expansion of many irrigation systems and water conservation facilities. Dams and reservoirs built between 1932 and 1947 added 250,000 acre-feet of water storage, and placed 102,500 acres of Indian lands under irrigation. This brought the total of Indian irrigated lands to 537,500 acres at a total cost of $58,000,000. An additional 300,000 acres of non-Indian land gets water from Indian irrigation projects. Investigations now are under way looking toward the development of all the potential irrigated Indian land, estimated at another 475,000 acres.

Until 1933 many Indian forest lands were inaccessible and undeveloped because of lack of funds, equipment, and trained personnel. The creation of the Civilian Conservation Corps in 1933 and the subsequent allotment of funds to the Indian Service for work on Indian reservations made possible an expanded and coordinated program of forest management. By 1942, when the work was suspended, $30,000,000 had been invested in truck trails, telephone lines, lookout towers, water facilities, blight eradication, and other forest and range improvements, exclusive of reforestation and range reseeding.

Beginning in 1941 the Bureau of Indian Affairs was given responsibility and separate funds for the conservation of soil and moisture resources on Indian lands. Since that time marked progress has been made in the conservation and restoration of land resources. Indian tribal councils, individual land owners, and lessees of Indian lands have contributed increasing amounts of money, labor, and materials to conservation work. In 1941 the proprietors and users of Indian lands barely matched Government expenditures for land conservation. By 1948 the contributions from the land owners and users amounted to $3 for each dollar spent by the Government.

Recently, the emphasis has shifted from stopping land depletion to the more affirmative approach of building up the soil through weed control, the planting of cover crops, green manuring, improved plowing techniques, the use of commercial fertilizer, strip cropping, and similar devices. On the Nez Perce and Coeur d'Alene Reservations in Idaho it is estimated that from 12 to 15 bushels per acre have been added to the wheat yield on Indian lands by these methods. The lands in question had been planted to wheat regularly for almost 50 years and in that period it is estimated that about 40 percent of the top soil had been lost.

Until 1933, roads in many Indian reservations were so bad that Indians were using pack animals and even their own backs to bring supplies into their communities. Even if they had products, Indians could not get them to market, nor could their children get to school in bad weather. A service-wide program of road construction got underway in 1934 and by 1948 Congress had appropriated more than $37,000,000 for new roads, $23,000,000 for improvements to roads and bridges, and $14,000,000 for maintenance. The Service today operates almost 8,000 miles of graded and drained roads, of which 3,300 are gravel and about 200 are paved.

Development of Indian human resources has kept pace with development of their natural resources. Appropriations for Indian health service increased from $2,677,800 in 1933 to $8,653,300 in 1948. During that period 46 new hospitals were constructed in the United States and five in Alaska. Nurses on duty increased from 298 in 1934 to 513 during the past fiscal year. The effectiveness of this health program is reflected in declining mortality rates. Deaths in 1928 occurred at the rate of 21.8 per thousand of population, while in 1945, the last year for which figures are available, the rate was down to 12.04 per thousand of population.

Education among Indian children has made like progress. In 1928 only 19 percent of all children in Indian schools were at their proper grade or only 1 year back. In 1946, the latest year for which statistics are available, this figure had risen to 62 percent. In 1928 only 12 Indian schools were offering high school courses and they were located away from reservations. Since then 26 reservation high schools have been added. A total of 27 accredited Indian Service 4-year high schools were operating in 1948. In 12 other schools 10 grades were offered.

Similar progress has been made in the development of Indian self-government and repeal of oppressive and discriminatory laws. The biggest advance was made in the Indian Reorganization Act of 1934 which gave tribes with written constitutions power to veto disposition of tribal assets by government officials. The Indian Reorganization Act stopped the alienation of Indian lands. Since that time, instead of losing more land, the Indians have acquired almost 4,000,000 acres.

But despite all the progress of the past 16 years the Indians still remain among the lowest income groups in the Nation. They must have long-range financial help to build their human and natural resources to the point where they can make their proper contribution to the national welfare.

Recognizing this need, the Department last year submitted to Congress the first of a series of regional programs for long-term capital investment in the Indian people. This program recommended the investment of $90,000,000 in the poverty-ridden Navajo and Hopi Reservations for schools, roads, hospitals, soil conservation, off-reservation employment, water development, creation of small industries and revolving loans, and a possible additional $60,000,000 ultimately for irrigation.

Only through bold long-range reservation planning of this kind, designed to build upon the natural resources and to meet the problems of each reservation, can the Indians realize their full potentialities as American citizens.

FISH

If we have been laggard in conserving and developing our land resources, we also have lagged in exploring and safeguarding the vast resources of the oceans which adjoin our land. The oceans contain unexplored and undeveloped fish and other resources of inestimable value to meet our ever expanding hunger for proteins. The recent war provided a dramatic illustration of the way seafood can supplement and augment short meat supplies.

World food shortages emphasize the importance of conserving known fisheries, developing new fishing grounds and fisheries for unutilized species, and making the most efficient possible use of the catch. As the population of the world increases, it must rely more and more upon the resources of the sea for its food. And yet we have overfished some areas to the point of destroying the basic resources, while leaving other areas virtually untouched, and even unexplored.

The United States produces from its fisheries 4 to 5 billion pounds annually of raw product yielding protein foods, vitamin oils, animal feeds, and other valuable byproducts. The 1947 production of the commercial fisheries was estimated 4.4 billion pounds of fish valued at $300,000,000 at the production level and $763,000,000 at the wholesale distribution level. But this yield could be vastly expanded. It has tripled within the past 68 years.

The fisheries of Alaska alone during the past 15 years of intensive operation have yielded products with a total value in excess of $800,000,000, as compared with the $7,200,000 we paid for that Territory. The average annual value of these products has been about $54,000,000 and in 1947 the all-time record was established with a haul valued at $107,166,931. The commercial fisheries are the mainstay of Alaska's economy. They are the chief source of employment, income, tax revenue, and shipping in the territory. They continue after 80 years of commercial utilization to yield increasing quantities of protein food products to meet world needs.

This emphasizes the important basic point that our fishery resources are renewable, if properly used. If overused, however, they can be destroyed, just as surely as our soil resources can be destroyed in the same way.

The salmon fisheries of Alaska are the most valuable in the world and are responsible for more than two-thirds of the world production of canned salmon. Production has totaled 85,000,000 cases in the last 15 years. A peak production of 8,437,603 cases was reached in 1936. But in recent years, due to increased commercial fishing and lack of an adequate enforcement staff to cope with illegal fishing, the pack has declined. It was down to a low of 3,970,000 cases in 1946, and 1947 was little better. Drastic regulatory controls have been established to restore this resource to its former abundance.

Alaska's fisheries can be maintained at a level of high productivity by an integrated program of scientific investigation, sound regulation, and vigilant enforcement. But these activities must be expanded. Some progress in this direction was made in 1947 when two additional airplanes, obtained from military surplus, and two new small patrol craft became available. Further expansion of scientific investigation and enforcement is planned.

Alaska fisheries furnish notable examples of the application of research knowledge. The yield of Alaska herring has increased substantially under controlled utilization, and the Karluk River salmon investigations have disclosed that in a lake which serves as a "nursery ground" for young sockeye salmon the fertility of the water, which can be artificially increased, is a vital factor in production.

Preservation of our fisheries is dependent on adequate statistics. Statistics indicating variations in the catch in relation to fishing effort, areas of capture, and methods by which the catch was taken are frequently the only measure of fluctuations in the condition and size of the stock of individual fish products. To be of maximum value, complete statistical information relative to the fisheries must be collected every year. Unfortunately, funds for gathering this essential data for all sections of the United States have been available in only 2 years—1880 and 1931. In other years we have had to rely on partial coverage.

One of the keys to the conservation of our fishery resources is to develop processing, distribution, and marketing to the point where all of the catch is devoted to the highest possible uses. Important technological studies are being carried on to determine a suitable means of salvaging waste by converting it into salable industrial products. In the Alaskan salmon industry alone, the cannery waste amounts to more than 100 million pounds annually. Waste products from other domestic fisheries probably bring this total up to 300 million pounds a year. Properly processed into marketable products this waste would become an asset rather than a detriment to the industry.

The utilization of fish waste for products other than oil and meal is being given increased attention. This material is a potential source of certain pharmaceuticals and other products for industry. A better conservation of our vitamin supplies may be attained by study of the factors affecting extraction of vitamin A from fish livers and the stability of this vitamin.

It has been estimated that the total catch of fishery products could be increased 325 million pounds annually through utilization of waste fish that are now destroyed by current methods of fishing for more valuable species. This destruction of small fish occurs principally in the North Atlantic, South Atlantic, and Gulf areas where quantities of small and unutilized species are taken incidentally in the trawl fishery for groundfish and shrimp. Investigation into the means of using these species is of paramount importance.

Even more important than conserving existing fish resources is the development of new and unexplored resources. Evidence indicates that waters more remote than those usually frequented by our fishermen support sizeable populations of fish. The tuna resources in the Central Pacific have never been measured and may be one of the world's richest. Exploratory fishing for king crab and bottomfish in the Bering Sea as far north as Nome is being accelerated. The anchovies of the Pacific coast are practically an untapped resource estimated to offer a potential yield of 250 million pounds annually.

We have lagged far behind the rest of the world in exploring the ocean resources. Other countries with important fisheries have had up to a score of fishery research vessels in operation. Until a year or so ago, the United States—with the second biggest fishery production—had none. We now have one—the Albatross III, in operation on the New England fishing banks to gather information relative to such valuable species as the haddock. Three more vessels are being prepared for work in the vast reaches of Oceania, where American interest in the tuna and other fisheries was aroused during World War II. Another ship is being prepared for investigations in the North Pacific, but other areas warrant such exploratory operations.

MINERAL RAW MATERIALS

Mineral raw materials are as much the lifeblood of modern industry as mineral fuels. Our industrial machine is chewing up every year more and more of our exhaustible mineral deposits. Some of our vital raw material minerals already may be nearing exhaustion, and for many of them we are digging deeper every year to come up with leaner ores.

Any exact or final measurement of our mineral resources is impossible to make. Undiscovered deposits cannot be accurately measured nor can future trends be precisely predicted. For instance, how long present reserves of iron ore will last depends not only upon our future rate of consumption, but also upon the discovery of new reserves, and the development of new processes which make it feasible to use ores that are not economically usable today.

But it does not require any exact measurement to disclose that some of our most essential raw materials already are in short supply and becoming increasingly costly to mine and process. As our supplies decrease, our demands increase. Every new advance in industrial technology creates additional needs for minerals—often the very minerals we need most for other uses.

No attempt will be made here to analyze our mineral supply situation in detail. The latest data on mineral resources were outlined in a joint report by the Bureau of Mines and the Geological Survey in 1947, entitled "Mineral Position of the United States." That report showed plentiful supplies of many minerals including magnesium, helium, nitrates, phosphate rock, potash, salt, and sulfur. But it also disclosed critical or possibly critical shortages of such materials as iron ore, copper, lead, and zinc, for most of which we have had ample supplies in the past; and continued shortages of such minerals as chromite, manganese, nickel, tin, quartz crystals, and asbestos.

Our dependence on minerals is so great, and our over-all supply is so uncertain, that we need to move quickly in every way possible to conserve our known deposits, find new deposits, develop techniques for using low grade and off quality reserves, and to synthesize and find substitutes for minerals in short supply. With respect to some of our minerals drastic action may be necessary to rationalize uses, so that our remaining supplies will not be wasted.

Conservation of our mineral reserves means, among other things, recovery of the highest possible percentage of our ores, rather than wasting those that prove difficult to get. Here is a place where some measuring stick other than the usual commercial judgment needs to be used. It may cost a little more to mine the last copper ore in a given mine, but we should not permit production to close down because of a few cents difference in the cost of mining, when national defense may be involved. Measured in terms of natural resources, that remaining copper may be cheap at the increased cost.

Finding new deposits and extending the limits of known deposits may be our biggest hope in meeting future demands for minerals. Both the Bureau of Mines and the Geological Survey are active in this program. They have tested thousands of domestic mineral deposits and are publishing the results. The work has yielded increased data on the importance of many of the deposits and in many instances has disclosed substantial reserves of critical and essential minerals, previously unknown. Some of these are now being developed by private capital. Others are of marginal character, not now capable of profitable exploitation, but they form a reserve of potential value for the future.

A low-grade copper deposit was developed in Arizona in the course of this program. It seemed at first too poor to be of current economic interest, but continued drilling indicated millions of tons of ore. Private capital took over the development, and at latest reports, had indicated by drilling the presence of nearly 500,000,000 tons of low grade ore, thus adding another to the several huge "porphyry-type" copper deposits from which the United States gets the bulk of its copper. Preparations for mining this deposit have begun.

The work on manganese and iron ore deposits have disclosed large reserves totaling hundreds of millions of tons. Only a part of this is of current usable grade, but part of the balance may enter the economic picture in the not too distant future.

As its current share in the program of finding new mineral resources, the Geological Survey during the fiscal year was actively conducting 71 field exploratory projects in metalliferous and nonmetalliferous geology. Because of the critical need for base metals, 24 of the projects dealt with copper, lead and zinc and 15 with deposits of iron and ferro-alloy minerals such as tungsten, chromite, and manganese. An extensive study of the phosphate deposits in Florida, Idaho, Montana, and Utah, was begun, and considerable attention was given to the geology pegmatites as sources of feldspar, mica and similar materials. The Geological Survey also is continuing aggressive field and laboratory research in the science and art of ore finding, including fundamental research directed toward increasing our understanding of the occurrence, mineralogy distribution, and origin of mineral deposits. Ore-finding covers a much wider field of science than it did when demands for minerals were more moderate and new deposits were easier to find. Today ore-finding and appraisal are highly complex and technical processes involving not only the many specialized fields of geology to an increasing degree, but geochemistry and geophysics as well.

The essential step in ore finding is regional geologic mapping because it provides the background for forecasts of the possible occurrence of ore. It also is essential in the search for and conservation of water resources, in land classification, in soil conservation, in dam, highway and other kinds of heavy construction, and in military planning.

But the United States has lagged far behind other nations in geologic mapping. Less than 10 percent of the Nation has been thus mapped on scales, adequate for modern use. We rank with backward nations of the world in this respect—far behind England, France, Germany, Japan, and Italy. The status of geologic mapping in the United States is comparable to that of Poland and Algeria—we are a little behind Algeria, but we are ahead of Poland.

Increased appropriations since the war have permitted a little increase in the rate of geologic mapping. But even at the present rate the job of mapping the United States will not be concluded for 180 years.

Topographic mapping of the country, needed in mineral findings as well as for other planning of natural resource development and national security, also is lagging far behind our needs. Aerial photography has speeded up the preparation of topographic maps, thus permitting current operations to include as much as 300,000 square miles.

Many of the maps previously prepared by the Geological Survey, since it began preparing such maps in 1879, are inadequate to meet modern needs; in fact, only about a fourth of the country can be considered adequately mapped.

At no previous time in history has the demand for topographic maps been so great. At least one request has been received for almost every tract of land in the country. In some instances as many as six or eight public agencies have requested maps for the same area. Requests for mapping Alaska alone total more than the area mapped in continental United States during the last 25 to 30 years. Topographic mapping, as well as other basic data studies, should be made to precede the planning and design of the great engineering projects carried out by the Bureau of Reclamation and other agencies. Our highway construction program is expected to cost $20,000,000,000 during the next 20 years. The economy that could be effected in road building alone, through the use of good topographic maps, would finance the completion of the standard topographic map for the entire United States. From a military standpoint, the provision of accurate topographic maps is an essential measure in the National Defense program.

The Bureau of Mines is giving special emphasis to the work of finding substitutes for scarce minerals and developing techniques for using low-grade ores. The metallurgical accomplishments of the Bureau during the war period and in the years since have been particularly outstanding. Lower grade ores and minerals were brought into production through improved ore-dressing methods; new structural materials have been developed, and synthetic mineral products have been substituted for scarce natural resources.

As the grade of our ores continues to decline, ore dressing becomes an ever-growing problem of increasing importance. The Bureau of Mines has developed new processes for producing concentrates from the ores. Already these developments have brought into the economic picture certain marginal deposits formerly considered impracticable to exploit. The Bureau's metallurgists have proved that many of the leaner ores of iron, copper, lead, and zinc can be economically upgraded, thus making possible the use of formerly uneconomic reserves.

Successful work also has been done by the Bureau of Mines in finding substitutes for scarce minerals. Substitutes have been developed for Indian Kyanite and for nickel, chromium, and tantalum for some uses. The Bureau now is studying methods of manufacturing synthetic products to replace sheet mica and spinnable asbestos, and to develop substitutes for diamonds in industrial production.

Another activity of the Bureau of Mines in the field of resource conservation is the development of uses for waste products such as vanadium and gaseous fluorine now lost in treating phosphate rock for fertilizer; the recovery of rare metals driven off and deposited in flues from smelting or roasting processes, and the production of light-weight aggregate for use in concrete.

Conservation of the lives of miners is a problem related to the conservation of mineral resources. Both the Bureau of Mines and the Geological Survey are active in this field. The Bureau of Mines is conducting studies to reduce the loss of life from roof and coal-fall accidents which account for approximately half of all fatalities in coal mines and made nearly 4,700 coal-mine inspections during the year. The Geological Survey requires safe and efficient operation of properties under its supervision. Ten out of twenty-three certificates of achievement in safety awarded to bituminous coal mines in the annual national safety competitions are held by Federal lessees.

PHOSPHATE

One of our mineral reserves—phosphate rock—is of such importance in agriculture that it deserves separate consideration in this report.

Phosphate rock is the raw material used in the manufacture of phosphate fertilizers and a large number of phosphorus compounds used in the food and chemical industries. A large part of the Nation's phosphate reserves are in the West—chiefly in Idaho, Utah, Montana, and Wyoming. There is a big and growing demand for phosphate fertilizer to maintain the soil of western farms. Yet almost all the plants manufacturing phosphate fertilizer are in the East, so that western farmers have paid in freight charges up to $60 a ton for phosphate plant food.

This combination of circumstances, plus the fact that the Northwest has much undeveloped water power which could be used for the production of phosphate fertilizer, has led the Department to conduct a many-sided investigation into the possibilities of creating a big phosphate fertilizer industry in the West. Private industry has begun to develop these possibilities and within a few years a greatly enlarged western industry, based on western resources, can be expected to provide cheaper fertilizer to maintain the fertility of western farms.

The West badly needs this development. Western farms are suffering from depletion of the soil. Because of the cost of fertilizer they have not been able to put back into their soils what they take out. Production year after year of record-breaking crops is increasing the need for fertilizer to replace the plant food which the crops take from the soil.

Responding to this need the western farmers, despite high freight costs, increased their use of phosphate fertilizers in 17 Western and North Central States from 35,000 tons before the war to 240,000 tons in 1947. Much of this had to be hauled from Tennessee and Florida.

It is estimated that farmers in these 17 States need 850,000 tons of plant food annually, or almost four times what they used in 1947. They probably would buy this much if they could get it at reasonable prices. It is in the national interest to help them get it as a means of developing soil-conserving farming practices.

There is one possible catch to this proposition. The bulk of western phosphate deposits must be mined by underground methods at higher cost than those in Florida, where most of the eastern deposits are located and where cheap strip-mining is possible. On the other hand, low-cost hydroelectric power, fuel, and low-priced sulfuric acid may overbalance this in the final cost of production—so that the shorter freight haul should put the fertilizer on western farms at lower costs. In addition, the western phosphate rock contains other elements such as vanadium and fluorine that may help to lower fertilizer costs when refining processes are perfected to recover these byproducts.

In order to provide for this new industry the Department has planned transmission lines to make available to the phosphate fields in Idaho and Montana cheap power from the Columbia River Basin. Potential sources of fuel and sulfuric acid are being investigated by the Department.

TERRITORIAL RESOURCES

America is fortunate to have available for development a new frontier a fifth as large as Continental United States and rich in natural resources. That new frontier is Alaska—a vast area of almost unexplored natural wealth, which may include many of the mineral and other raw material supplies we need most. Its fisheries already have been developed into a major industry. Other big industries probably can be developed from Alaska's forests, waterpower, agricultural land, furbearing animals, and tourist attractions, as well as its minerals.

In developing Alaska's resources we have an opportunity to apply the lessons we learned from both our successes and failures in developing resources at home. The Government still owns most of the land—just as it did originally in the western part of the United States. We have a choice of opening that land for unplanned and possibly wasteful exploitation, or deciding in advance the best ultimate use of these resources and developing them according to plan.

Under the first alternative we would give away natural assets in wholesale quantities to encourage private enterprise to exploit the area, as we did in the western part of continental United States. Under the second alternative, the Government would put money into the territory for planning and providing access to the resources as a basis for their wise development by free enterprise. This plan costs more money at the outset, but means tremendous savings ultimately in the conservation and efficient development of the resources. Fortunately we have so far chosen the second alternative. Instead of giving away the resources to encourage private development of the railroad, for instance, the government has built and maintained the railroad system.

But until the outbreak of World War II, when Alaska suddenly acquired military importance, development of the area had been handicapped by the failure of the Government to open up the Territory for development. Even now the inventory of Alaska's natural resources is far from complete. Only a small fraction of the 225 million acres of vacant public land in the Territory has even been surveyed, and only a million acres have been classified for use. Exploration of its minerals has barely begun.

In order to plan a wise resource development program for Alaska we need to speed up our topographic and geologic mapping of the area and follow up with detailed mineral investigations and survey of potential transportation routes and power sites. These are essential to wise over-all planning for development of the area. Yet until the past fiscal year progress in this direction had been almost imperceptible.

During the year just ended, the Department of Interior expanded the Alaskan development program substantially, and presented to Congress plans for a still more rapid development of the area. During the 1948 fiscal year appropriations for the Interior Department's Alaskan development program jumped to $16,559,863, plus contract authorizations of $15,000,000 as compared with total appropriations of only $9,999,062 the year previously.

These additional appropriations provided for speeding up construction of Indian facilities such as schools and hospitals; expansion of mineral resource investigations, and investigations of fisheries; faster construction of roads and the beginning of a 3-year program for rehabilitating the Alaska Railroad.

Appropriations to the Department for the Alaskan development program during the 1949 fiscal year are $37,225,257, plus additional contract authorizations of $31,829,000.

These bigger appropriations will permit the Department still further to speed up rehabilitation of the railroad and construction of roads; start an investigation of water resources for development of hydroelectric power; increase fire protection in the forests; speed up land classification, mapping, and mineral resource investigations; and start construction of a mining experiment station. More money also was provided for enforcement of the conservation laws protecting the fisheries and fur seals.

The 1949 appropriations for topographic mapping and planimetric mapping were increased four times over the 1948 funds; appropriations for mineral resource investigations and geologic surveys were increased about a quarter; funds for gaging streams were tripled; and appropriations for the investigation and development of mineral deposits were increased nearly three times. Appropriations for roads, which are necessary to provide access to Alaska's resources, were more than doubled. For the first time in peacetime history, sizeable amounts of money were being devoted to building up Alaska's transportation system.

From the standpoint of national security, as well as fairness to the people of Alaska, these appropriations for development of the territory have come none too soon. Alaska has been under the American flag for more than 80 years, but until recently has lacked for development money. During that period, while the population of continental United States has grown by 100,000,000 people, only 64,000 have settled in Alaska exclusive of military personnel. Even adding the aboriginal population of 30,000 this provides only 1 inhabitant to every 8 square miles. The Scandinavian countries and Finland, comparable in climate and terrain, have 13,000,000 people living in economic stability on only two-thirds as much land.

Alaska's timber and minerals can provide most of the raw materials for developing the area. But those timber and mineral resources cannot be made available until roads are built, until housing is available for workers and their families, and until water power is developed to process the raw materials. Eventually these raw materials should provide a flourishing export business to help finance the economy and reimburse the Government for its expenditures.

Quicker classification of the land and revision of the land laws are needed to make acquisition of the land easier. With Alaska's superabundance of land, and lack of population, it must be made easy to obtain land for uses that fit into long-range development plans.

Other prime needs in Alaska are more and better housing, conservation to protect the fisheries and wildlife, improved health facilities, tourist accommodations, better water transportation, and adequate information and advice for farmers.

These things should be provided as soon as possible. We have spent less, comparatively, for Alaska's development than for opening the West. Our national interest calls for an increase in the permanent population of Alaska. The urgency is based not only on the importance of expanding our known reserves of mineral and other resources but upon national security.

Hawaii is another territory with possibilities of resource development. Hawaii, in addition to serving as a strategic military outpost, has important natural resources including land, fisheries, forests, and recreational assets.

Most of Hawaii's wealth has been built upon its soil, which produces rich sugar and pineapple crops. The land used for these cash crops has been well maintained, but that has not been true of nearly a third of the territory's land which is used for grazing. Serious soil waste has occurred on the grazing lands due to overgrazing and permitting the land to be overrun by nonpalatable noxious weeds. Further research is needed into the adaptability of other crops to the climate and soil, and into irrigation, so that Hawaii's limited acreage can be put to its highest use.

Hawaii's forests have been used primarily to protect its water supplies for its valuable crops. The replanting of native hardwood trees has been unsuccessful, but there is evidence that trees of exotic species with highly prized wood could be produced commercially on lands formerly occupied by native trees. This utilization of marginal lands offers great promise.

Fishery resources in Hawaii also offer great development potentialities. It is estimated that less than 5 percent of the usable surplus of tunas which pass through the territorial waters are harvested. This is because the catch has been limited by a fishing technique dependent on live bait seined out of inshore waters, the supply of which is limited. Exploration of the deep-sea fishery resources and development of better techniques for harvesting the tuna would create a major industry for the benefit both of Hawaii and the Nation.

Hawaii has a spectacular beauty and a climate which are attracting a growing tourist trade. But much more needs to be done to develop proper accommodations and provide recreational facilities for tourists.

ALASKAN TIMBER

One of the raw products on which America depends is newsprint, the paper on which its newspapers and magazines are printed. It is made from certain kinds of wood such as spruce and hemlock which are plentiful in only a few parts of the world. One of these areas in Alaska. The United States is the world's biggest consumer—and has to import most of its needs. We, along with the rest of the world, have difficulty getting enough. It should be possible to develop a newsprint industry in Alaska which would benefit the Territory as well as the Nation.

The world shortage of newsprint is estimated at somewhere between 1 and 2 million tons a year. In Great Britain newspapers are limited to four pages. In the United States small newspapers, including religious and trade union publications, are constantly threatened by the shortage and resulting high price of newsprint. Many publishers manage to get enough through long-term contracts and by ownership of producing companies. But the shortage for some smaller publications operates as a limitation on freedom of the press in this country, and seriously impedes the flow of information throughout the world.

Demand for newsprint in the United States is rising rapidly. Our newsprint consumption in 1947 was the highest on record—4,753,000 tons. Consumption in 1948 is estimated at 5,000,000 tons, and by 1960 it is expected to reach about 5,500,000 tons.

Alaska offers a solution to the problem of newsprint supply. The Territory has vast, undeveloped spruce and hemlock forests. It is estimated that under sustained yield management of the Alaskan forests, they could produce enough newsprint to meet about a quarter of our present national demand indefinitely. This would be a boon for the Territory and a boon for the free press of America. The

Interior Department is continuing its efforts to interest newsprint producers in the possibilities of Alaskan timber.

During the past year the United States Forest Service approved a contract for construction of a pulp mill near Ketchikan in Southeast Alaska which will ultimately produce 500 tons of pulp a day. It has a timber supply sufficient to maintain that capacity in perpetuity. A second company also is negotiating for such a mill, but so far the newsprint industry has not moved into Alaska. The pulp in both instances is planned for use in manufacturing rayon.

Construction of this first pulp mill is a big industrial advance for Alaska. It means the investment of $30,000,000 and jobs for 1,000 men. But it will only indirectly affect the shortage of newsprint in the United States. There is plenty of room in Alaska for a newsprint industry.

Recommendations

THIS report has outlined some of America's more serious natural resource problems. These are problems of such consequence to the future welfare of America that I feel strongly we cannot allow them to go much longer without adequate solutions.

The longer we delay finding answers to them the poorer we become in some of the vital natural resources on which America's future strength and prosperity depend. During the past 16 years the Government has made great progress in recognizing these problems and dealing with them but our remedial efforts have been "too little and too late." We need to do a great deal more than we have done so far.

Some additional measures are clearly and unmistakably necessary. We must push ahead as rapidly as possible with the development of all practicable hydroelectric power. We need to develop within the next 20 years at least 40 million kilowatts. The Federal Government probably will need to build at least 30 million of those kilowatts at a cost of 12 billion to 15 billion dollars. This program should include the St. Lawrence power and sea way which is needed not only for power, but also for transportation. This second need may soon become paramount in order to bring the newly important iron ore from Labrador and South America to American steel plants.

Another absolute essential to our future protection is the rapid development of our synthetic fuels program. The Government should invest whatever is necessary to push ahead with this program. If private enterprise is unwilling to take the risk, the Government must.

More than almost anything else we need to push our program of discovering and developing hidden mineral resources. Canada and Labrador have discovered a new "Mesabi range" of iron ore. We may have such assets hidden in the United States or in the unexplored interior of Alaska. If so, we need to find them. The Geological Survey should employ every competent geologist it can find to speed up our geologic exploration. The Bureau of Mines should be given all the money it can spend efficiently in the development of techniques for using low grade ores, and substitute ores. The Geological Survey and The Reclamation Bureau should be authorized to proceed as rapidly as possible with surveys of our potential water resources in the West and in Alaska.

These are the obvious and unchallenged needs for the protection of our future national safety. In addition we must meet the need for immediate measures to protect the Nation's economy from the effects of critical shortages. we must be prepared to allocate scarce basic materials such as copper, lead, and zinc.

I cannot close this report without once more calling attention to the urgency of these problems. We are engaged today in a world-wide ideological struggle involving the future of our nation and the future of democracy. Our success in that struggle depends to a large extent upon our ability to make our system work so well that its superiority cannot be challenged. That, in turn, depends on our supply of raw materials. With so much at stake, we cannot afford to take chances and hope we will have enough. We must make sure we will.

PART II

Annual Reports of the Bureaus and Offices of the Department of the Interior

Bureau of Reclamation

MICHAEL W. STRAUS, *Commissioner*

Design and Construction

THE construction program of the Bureau of Reclamation during fiscal year 1948 reached the highest mark of accomplishment in the history of Reclamation. Despite continued shortages of labor in some areas, deficiencies in certain types of construction materials, prolonged delivery periods for large manufactured equipment, and severe limitations on design offices, 169 million dollars of construction work was completed.

Among the principal project features completed are the following:

Alva B. Adams Tunnel—Colorado-Big Thompson project, Colorado.
Prospect Mountain and Ramshorn Tunnels—Colorado-Big Thompson project, Colorado.
Altus Canal—W. C. Austin project, Oklahoma.
Coachella Main Canal—All-American Canal system, California.

At the end of the year construction was in progress on authorized projects on 25 dams (including 2 diversion), 11 power plants, 26 pumping plants including the major installations at Coulee Dam and Tracy, Calif., 249 miles of main canals, and 1,592 miles of transmission lines.

Project development was continued with major contracts awarded for construction of 14.7 miles of the Friant-Kern Canal and 13.6 miles of the Delta-Mendota Canal on the Central Valley project, California. Construction of a highly specialized underground irrigation distribution system for the Coachella Valley, Calif., was started with award of contracts for the first four units containing 21,200 acres. Power development progressed with award of contracts for turbines and generators for the second group of three 108,000-kilowatt generating units for the right powerhouse at the Grand Coulee Dam, Columbia Basin project, Washington. Initial contracts were awarded for construction of a transmission substation at Beulah, N. Dak., and 115-kilovolt transmission line from Gering to Sidney, Nebr., and from Sidney, Nebr., to Sterling, Colo.

The high light of the year was the award of a contract on April 21, 1948, for construction of the Hungry Horse Dam and power plant in

Montana. This contract in the amount of $43,431,000 for construction of a 520-foot-high concrete arch dam and 285,000-kilowatt capacity power plant is the second largest contract to be awarded in Reclamation history, being exceeded in amount of money only by the contract for Hoover Dam. Other outstanding awards during the fiscal year included contracts for the Boysen Dam and power plant, Boysen unit ($13,900,000); the Medicine Creek Dam, the Frenchman-Cambridge unit ($4,270,000); and the Heart Butte Dam, Heart River unit ($2,360,000); all on the Missouri River Basin project. A construction contract in the amount of $2,499,000 was awarded for completion of the Anderson Ranch Dam and power plant on the Boise project, Idaho.

Preconstruction activity was accentuated with award of contracts for Government camps on the Canyon Ferry, Narrows, and St. Francis units of the Missouri River Basin project.

CONTRACT AWARDS

The total value of all contracts awarded during fiscal year 1948 amounted to about $160,000,000. This amount, comprising the face value of over 1,400 separate contracts for construction, materials, equipment, and supplies, represents the largest volume of contracts ever awarded by the Bureau of Reclamation in a fiscal year. Of the total contract amount, construction contracts accounted for $105,000,000 or about 65 percent. By comparison, construction contracts awarded during the previous year amounted to approximately $62,000,000. Following is a summary of the major contracts awarded during fiscal year 1948:

Hungry Horse Dam and power plant	$43, 431, 000
Boysen Dam and power plant	13, 900, 000
Medicine Creek Dam	4, 270, 000
Heart Butte Dam	2, 360, 000
Completion of Anderson Ranch Dam and power plant	2, 499, 000
14.7 miles Friant-Kern Canal	4, 826, 000
13.6 miles Delta-Mendota Canal	4, 418, 000
Units 1, 2, 3, 4, Coachella Distribution System	3, 797, 455
Cement for Hungry Horse Dam (2,500,000 barrels)	8, 281, 000
Generators for units R–4, R–5, and R–6 at Grand Coulee Dam	5, 328, 000
Turbines for units R–4, R–5, and R–6 at Grand Coulee	2, 503, 000
Generators (4) for Hungry Horse power plant	4, 414, 000
Turbines (4) for Hungry Horse power plant	2,150, 000

EXHAUSTION OF FUNDS

Construction progress was accelerated on Reclamation work generally during the fiscal year. Contractors who had experienced difficulty since the war in developing their organizations and acquiring necessary equipment and materials had largely overcome these difficulties by the beginning of the fiscal year and had stepped up production on all fronts. On the Central Valley project in California the rate of progress so far exceeded the anticipated program that funds available for construction of the Friant-Kern Canal were exhausted by November 30, 1947. With the exhaustion of funds all contractors working on the canal suspended operations. Rapid construction progress threatened to cause an exhaustion of available funds on other features of the Central Valley project, and on the Columbia Basin project, the Colorado-Big Thompson and the Davis Dam projects, but timely appropriations of supplemental funds by the Congress averted this occurrence. Total supplemental appropriations in the amount of $35,939,000 were made to meet the requirements of the contractors' accelerated construction operations during the fiscal year.

NEW CONTRACT PROVISIONS

The inadequacy of appropriations and the consequent exhaustion of funds on certain projects or features of projects pointed up the desirability of spelling out more clearly in our contracts the respective rights and obligations of the contracting parties in the event of an exhaustion of funds. Accordingly, there are now incorporated in contracts running into more than one fiscal year provisions similar to those used by the Corps of Engineers.

Under these new provisions each contractor is informed before the submission of his bid as to the amount of funds initially reserved for payment of earnings under the contract. When additional funds are made available further advice as to amounts reserved is given to the contractor. Should funds become exhausted before the completion of a contract, the contractor may, as he elects, suspend work pending the availability of additional funds, or continue work at his own risk in anticipation of additional funds being made available. In the event Congress should fail to provide additional funds during its regular session, the contract may be terminated at the option of the contractor.

RISING COSTS

Costs of both material and labor, which have risen sharply since the end of World War II, continued to climb during fiscal year 1948. The following table of Bureau of Reclamation construction cost indices shows the relative increase in costs of principal types of Reclamation work. These cost indices are based on the combined costs of material and labor furnished by contractors, and material furnished by the Government. They are based on actual experience and reflect contract bid prices for construction contracts and materials, equipment and supply contracts as well as other components of Reclamation construction costs.

Cost indices based on January 1940 costs=1.00	July 1947	January 1948	June 1948
Dams:			
Concrete	1.85	2.00	2.00
Earth	2.05	2.10	2.15
Powerplants and pumping plants:			
Building	2.10	2.25	2.30
Equipment	1.55	1.60	1.80
Penstocks or discharge pipes	1.95	2.00	2.25
Transmission systems:			
Wood pole lines	2.20	2.40	2.50
Substations	1.60	1.70	1.80
Waterways:			
Canals, laterals, and drains	2.15	2.25	2.30
Tunnels, free flow, concrete lined	1.95	2.00	2.20
Roads and bridges:			
Primary roads, surfaced	1.90	2.00	2.10
Secondary roads, unsurfaced	1.95	2.05	2.20
Bridges	2.15	2.20	2.20

The composite cost index for all types of Reclamation work at the close of fiscal year 1948 stood at about 2.15 relative to 1.00 in January 1940, and 2.05 at the beginning of the year.

SHORTAGES

Supplies of many types of construction material and equipment continued to be short of the requirements of the construction program. Among the more critical items were reinforcement steel for concrete work; steel plate for power penstocks; copper and aluminum conductor, insulators and line hardware for high-voltage transmission lines; lumber in select and seasoned grades; and wrought-iron pipe. Large electrical equipment such as transformers, oil circuit breakers and generators which are manufactured to individual specifications require 2 years or more for delivery. The minimum time quoted for delivery of large generators in the most recent bids for the Hungry Horse generators is 1,150 days, about 3 years and 2 months. With such long delivery periods prevailing, it has been necessary to award contracts for special electrical equipment very early in order that the equipment may be available for installation in accordance with the construction program.

The supply of cement has recently begun to run behind the demands of the construction industry. The demands of private, municipal, and State agencies, in addition to reclamation and other Federal requirements, have steadily increased since the war until now the combined demand is about equal to the mill capacity of the 17 Western States This demand is expected to continue to increase. Thus far the Bureau of Reclamation has experienced no insurmountable difficulties in obtaining adequate quantities of cement since contracts have been awarded months in advance of required delivery dates. Recently however, as a result of the tightening situation, it was necessary for the Bureau to contract for deliveries of cement from a mill in Pennsylvania for use at Angostura Dam in South Dakota, in order to obtain sufficient quantities to meet construction schedules.

LIMITATION ON DENVER DESIGN OFFICES

Production of designs and specifications for the increasing volume of construction was severely handicapped at the beginning of the fiscal year by a provision of the 1948 Interior Department Appropriation Act which limited to $7,800,000 the amount of appropriated funds which could be spent for Denver office design operations. The Congress had never before imposed a limitation on the engineering expenditures of the Bureau of Reclamation. Under the new limitation it was necessary to reduce drastically the design staff which had been organized to serve the growing construction program which had been authorized and for which the largest appropriations in Reclamation history had been provided. In the reduction of forces over 1,000 employees were separated from service.

But the furnishing of designs and engineering services was still essential if the construction program was to be kept on schedule. To produce designs and specifications necessary to keep the program rolling, design offices were established in the field as close to the active projects as possible, and a portion of the design work load was delegated to these offices. Staffing of the field design offices has been a slow process due to difficulties in obtaining suitable housing facilities in some areas, reluctance of key personnel to accept transfer to some localities, and a general dearth of qualified design engineers. By the end of the year 35 design offices had been opened throughout the 7 regions and were functioning. The staffs of these offices, however, contained only about 63 percent of the number of personnel required to carry the work load which had been delegated to them.

The restrictive forces thus imposed upon the Bureau's design function were manifested in the amount of programed work which remained unperformed at the end of the year. While every effort was made to furnish the necessary designs and related services for the greatest volume of construction ever undertaken by the Bureau, many design studies and laboratory research work needed to keep the Bureau practice in line with technologic advances had to be eliminated or suspended, and basic design work on many future projects had to be set aside in order to keep up with the immediate needs of the program. As one result of the necessity of applying limited staffs to first needs first, the Bureau was able to place under contract during the fiscal year only 2 of the 13 major flood-control dams in the Missouri River Basin for which funds were appropriated in the Second Supplemental Appropriation Act, approved July 31, 1947.

FORCE ACCOUNT

The Interior Department Appropriation Act, 1948, imposed for the first time in the Bureau's history a legislative restriction on the use of Government forces for doing construction work. The act provided that the appropriated funds were not available for construction work by force account or hired labor, with certain exceptions, including operation and maintenance, emergencies, and routine minor construction regardless of whether this method was the most economical. The restriction probably was an outgrowth of insistence by contractors and contractors' organizations that practically all reclamation construction should be performed by contract.

The policy of minimizing work done with Government forces was not new because for many years only a small portion, estimated at less than 5 percent of the Bureau's construction, had been done by other than contract means. On the other hand new administrative controls were required to insure compliance, however, and records had to be kept so the Congress could be informed as to the extent of the Bureau's force account program.

In most regions the effect of the limitation on construction operations was distinctly minor because the types of work being done by Government forces were well within the exceptions permitted by the limitation. The greatest effect was on the Columbia Basin project where a considerable amount of force account work had been undertaken after the war in the vicinity of Coulee Dam, particularly on pumping plant construction, feeder canal excavation, and installation of hydraulic turbines and related equipment. When the terms of the limitation were known, this work, except for equipment installations, was abruptly curtailed. The number of force account employees on the project was reduced by more than 65 percent, a reduction of approximately 1,000 men.

Subsequently two contracts were awarded and at the end of the fiscal year preparations were nearly complete for the award of two more which would accomplish by contract a substantial amount of work which had been scheduled for force account performance.

Other than on the Columbia Basin project the most notable effect of the limitation was on the construction of temporary Government camps for units of the Missouri River Basin project. Construction of housing facilities by Government forces was under way on some units, and planned in others, to avoid the delays inherent in preparing specifications, advertising for bids and awarding contracts. The Bureau was under pressure to initiate work very rapidly on the Missouri River Basin units. Housing for personnel investigating dam sites and securing data on which to base designs was a bottleneck affecting the entire program because of the difficulty of recruiting and efficiently utilizing personnel without these facilities. The program was delayed on some units by as much as 3 or 4 months by having to change from force account to contract construction of housing. Several contracts have since been awarded for the construction of camps for Missouri River Basin units.

RESEARCH

Research activities in the Denver laboratories were directed to investigation of construction materials, analyses of structural designs, and development of improved methods and materials for effecting economies in the construction and operation of reclamation projects. A large portion of laboratory time was given to testing concrete aggregates to be used in concrete dams, canal linings, power plants, etc., and earth materials to be used in compacted embankments of earth dams, canal banks, and structure foundations. Special tests were conducted on concrete mixes for various types of aggregates and cements. Studies were made on cavitation erosion of various concrete types and on protective coatings for concrete. The effect of reactions between certain aggregates and cements on the disintegration of concrete was investigated. Experiments were carried out to develop an improved lightweight concrete for use in building construction. Various foreign cements were tested to determine whether any would be superior to American products for Bureau use. Extensive tests were carried out at Enders Dam under supervision of the laboratory on a vibroflotation method of compacting in place soils consisting of sand and silt.

Investigations were continued on methods and materials suitable for low-cost canal linings although this work was reduced to a minimum by the limitation placed on the Denver offices by the 1948 Appropriation Act. Work accomplished during the year included testing of various asphaltic and cement preparations proposed for canal linings.

Methods were also studied for reducing seepage in earth canals. Some of the methods investigated involved the application of impervious clays and soils to the sides and bottoms of canals, installation of an asphaltic membrane in the canal prism, and application of hot asphalt cement to the subgrade and covering with earth.

Hydraulic model tests were made of proposed designs for spillways, outlet works, and many other hydraulic structures. These tests frequently reveal deficiencies in preliminary designs and point the way to corrective measures, thereby saving the Government many times their cost in construction economy.

Geologic investigations were made of the sites of dams, power plants, and major structures under construction or proposed for construction. Similar investigations were carried out to determine the suitability of proposed reservoir sites for storing water. A great amount of such work, for instance, was required to determine the adequacy of the Hungry Horse Reservoir for storage purposes.

Other types of work which are performed by the laboratory for the benefit of Bureau operations include chemical analyses of water; tests of oils and paints, investigation of chemicals and means of application to control the growth of noxious weeds along irrigation canals; and structural studies of new steel and aluminum alloys, plastics, and fabrics, including model tests of designs using these materials and the behavior of materials under varying conditions of use.

WORK PERFORMED FOR OTHER AGENCIES

The Bureau has undertaken engineering work for outside agencies and other Government departments where the Bureau has been requested to perform such work, and the cost thereof has been covered by funds provided in advance by the agency requesting the work. On May 4, 1948, announcement was made of approval of an agreement between the Bureau of Reclamation and the International Boundary and Water Commission under which the Bureau immediately undertook to prepare detail designs and specifications for the $36,000,000 Falcon Dam and Reservoir which is to be built by the Commission on the Rio Grande River about 60 miles downstream from Laredo, Tex., as provided by the Water Treaty of 1944 between the United States and Mexico. The dam will create a storage reservoir having a total capacity of 3,300,000 acre-feet, of which 2,100,000 acre-feet will be divided between the two countries. A large amount of hydroelectric energy will also be generated to be divided equally between the two countries. Under the agreement the Bureau is to give top priority to this work in an effort to complete it well in advance of November 8, 1953, the date by which the Water Treaty requires its completion.

The Bureau is also collaborating with the International Boundary and Water Commission on problems related to construction of a diversion dam on the Colorado River at or below the International Boundary. Work to date includes studies of river conditions which will be created by the proposed works and the effect of such works on existing developments along the river in the United States.

Investigations of the structural behavior of the mass concrete forming the Ross Dam of the city of Seattle, Wash., were undertaken by the Denver laboratories under a contract with the city.

Other work performed for outside agencies included lightweight concrete investigations for the National Housing Agency; aggregate investigations for the South Holston Dam of the Tennessee Valley Authority; alkali-aggregate reactivity tests at Alma Dam for the United States Engineers; concrete mix design and tests on durability of concrete for Cherry Creek Dam, also under the United States Engineers; testing paint materials for compliance with sepecifications for the United States Treasury Department, and investigation of roofing materials and soil tests on foundation materials for a Veterans' Hospital at Albuquerque, N. Mex., for the Veterans' Administration. Investigations and studies were conducted for the Salt River Valley Water Users' Association on designs and structural conditions of the Horse Mesa and Stewart Mountain Dams of the association on the Salt River in Arizona to determine whether present structures are adequate for operation of the reservoirs to the tops of the spillway gates. Results of these investigations proved the safety of the dams.

During the year Bureau of Reclamation mapping activities were coordinated with the mapping programs of such primary mapping agencies as the Geological Survey to insure that no duplication of effort occurred.

The Bureau continued cooperative seismological studies with the Coast and Geodetic Survey and National Park Service at the Hoover Dam, Shasta Dam, and Grand Coulee Dam, and initiated studies at Hungry Horse Dam with the installation of a seismograph at that site in October 1947.

Contracts for aerial photography and mapping were awarded for areas in California and South Dakota where topographic mapping was required in connection with the Central Valley project and the Missouri Basin project, respectively.

Twenty-seven invention reports on inventions developed by Bureau of Reclamation employees were processed during the year.

INTERNATIONAL COOPERATION

The Bureau received 500 technical study tours or visits from foreign public work officials, engineers, and student apprentices from 35 countries, including the Italian Food Minister, Belgian Congo Public Works Adviser, and Afghanistan Public Works Minister. Among visiting groups was 30 Siamese civil servants in training for a year on all phases of irrigation in order to form a nucleus of a Siamese irrigation service on the American model.

Requests for some 30 engineers for service abroad came from the State Department; only 10 could be supplied, for service such as confidential missions, official representation on international technical congresses in Europe and short loans to foreign governments on preliminary investigations of public works that later would involve purchase of American equipment and technical aid. Reclamation engi-

Federal reclamation storage dams, June 30, 1948

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
ARIZONA								
Salt River	Bartlett	Verde	Concrete multiple-arch	[2] 179, 500	287	1, 063	182, 000	1939
	Cave Creek [1]	Cave Creek	do	11, 000	109	1, 648	18, 775	[3] 1923
	Horse Mesa	Salt	Concrete arch, power plant	[2] 245, 100	300	803	162, 900	[3] 1927
	Mormon Flat	do	do	[2] 57, 900	224	505	59, 900	[3] 1925
	Roosevelt	do	Masonry arch-gravity, power plant	[2] 1, 398, 000	280	1, 125	355, 800	1911
	Stewart Mountain	do	Concrete arch, power plant	69, 800	207	1, 260	131, 700	[3] 1930
ARIZONA-CALIFORNIA								
Parker Dam Power	Parker [1]	Colorado	do	717, 000	320	856	380, 000	1938
ARIZONA-NEVADA								
Boulder Canyon	Hoover (Boulder)	do	Concrete arch-gravity, 2 power plants	31, 142, 000	726	1, 244	4, 400, 000	1936
Davis Dam	Davis	do	Earth, power plant	1, 820, 000	200	1, 300	4, 357, 500	(4)
CALIFORNIA								
Central Valley	Friant [1]	San Joaquin	Concrete gravity	521, 000	319	3, 488	2, 135, 000	1942
	Keswick [5]	Sacramento	do	23, 800	159	1, 046	197, 000	(4)
	Shasta	do	Concrete curved-gravity, embankment wing, power plant.	4, 493, 000	602	3, 460	8, 710, 000	1945
	Martinez	Offstream	Earth		38	1, 200	183, 450	1947
Orland	East Park	Little Stony Creek	Concrete arch-gravity	51, 000	137	249	15, 745	1910
	Stony Gorge	Stony Creek	Concrete slab-and-buttress	[2] 50, 200	139	868	43, 100	1928
COLORADO								
Colorado-Big Thompson	Dixon Canyon	Offstream	Earth	(S-54)	240	1, 215	3, 004, 000	(4)
	Granby	Colorado	do	546, 000	295	885	2, 901, 300	(4)
	Green Mountain	Blue	Earth, power plant	154, 600	309	1, 150	4, 406, 000	1943
	Horsetooth	Offstream	Earth	146, 000	150	1, 610	1, 890, 000	(4)
	Marys Lake [3]	do	Earth (2 dikes), power plant	700	35	1, 450	75, 000	(4)
	Olympus [1]	Big Thompson	Concrete gravity, embankment wing	2, 850	60	1, 850	300, 000	(4)
	Shadow Mountain	Colorado	Earth	15, 000	44	600	210, 000	1946
	Soldier Canyon	Offstream	do	(S-54)	231	1, 420	3, 288, 000	(4)
	Spring Canyon	do	do	(S-54)	215	1, 115	2, 213, 000	(4)
Fruit Growers	Fruit Growers	Alfalfa Run	do	4, 600	55	1, 420	135, 500	1938
Mancos	Jackson Gulch	Offstream	do	10, 000	181	1, 895	1, 988, 000	(4)
Pine River	Vallecito	Los Pinos	do	129, 700	162	4, 010	3, 738, 000	1941
Uncompahgre	Taylor Park	Taylor	do	[2] 106, 200	206	675	1, 115, 100	1937
IDAHO								
Minidoka	American Falls	Snake	Concrete gravity, embankment wings	[2] 1, 700, 000	94	5, 227	313, 600	1927
	Jackson Lake	do	do	[2] 847, 000	70	4, 920	491, 700	1911
	Minidoka [1]	do	Earth with concrete powerhouse section, power plant.	[2] 95, 200	86	4, 475	257, 300	1906

IDAHO-OREGON								
Boise	Anderson Ranch	Boise, North Fork	Earth, power plant	493, 200	456	1, 350	9, 653, 300	(4)
	Arrowrock	Boise	Concrete arch-gravity	[2] 286, 500	350	1, 150	636, 000	1915
	Cascade	Payette, North Fork	Earth	700, 000	107	785	395, 000	(4)
	Deadwood	Deadwood	Concrete arch	[2] 164, 000	165	749	56, 400	1931
	Deer Flat, Upper	Offstream	Earth	190, 100	74	4, 000	1, 245, 000	1908
	Deer Flat, Lower	do	do		46	7, 200	1, 240, 000	1908
IDAHO-WYOMING								
Upper Snake River Storage	Grassy Lake	Grassy Creek	do	15, 500	118	1, 170	541, 600	1939
	Island Park	Snake, Henrys Fork	do	127, 600	91	9, 448	464, 000	1938
MONTANA								
Bitterroot	Coro	Rock Creek	do	31, 800	65	2, 550	1, 106, 000	[3] 1910
Hungry Horse Dam	Hungry Horse	Flathead, South Fork	Concrete arch-gravity, power plant	3, 500, 000	520	2, 115	2, 900, 000	(4)
Huntley	Anita	Offstream	Earth	[2] 400	42	1, 050	142, 800	1937
Milk River	Fresno	Milk	do	129, 100	111	2, 070	2, 105, 000	1939
	Nelson	Offstream	Earth (5 dikes)	85, 500	28	9, 900	232, 600	1915
	Sherburne Lakes	Swiftcurrent Creek	Earth	[2] 66, 100	96	1, 086	227, 600	1921
Sun River	Gibson	Sun, North Fork	Concrete arch	[2] 105, 000	199	960	167, 500	1929
	Pishkun	Offstream	Earth (8 dikes)	46, 400	50	9, 180	599, 300	1921
	Willow Creek	Willow Creek	Earth, semihydraulic fill	[2] 32, 400	93	650	274, 900	1911
NEBRASKA								
Frenchman-Cambridge (Missouri Basin).	Enders	Frenchman Creek	Earth	74, 000	134	2, 603	1, 951, 000	(4)
Mirage Flats	Box Butte	Niobrara	do	31, 300	87	5, 508	1, 422, 000	1946
Frenchman-Cambridge (Missouri Basin).	Medicine Creek	Medicine Creek	do	150, 000	167	4, 400	2, 360, 000	(4)
NEBRASKA-WYOMING								
North Platte	Guernsey	North Platte	Earth, power plant	[2] 48, 100	135	560	586, 200	1927
	Lake Alice, Upper	Offstream	Earth	11, 400	30	3, 100	240, 600	1913
	Lake Alice, Lower	do	do		23	2, 550	119, 000	1912
	Minatare	do	do	[2] 60, 800	63	3, 700	696, 100	1915
	Pathfinder	North Platte	Masonry arch-gravity	[2] 1, 070, 000	214	1, 070	65, 700	1909
NEVADA								
Humboldt	Rye Patch	Humboldt	Earth	[2] 179, 000	80	914	356, 300	1936
Newlands	Lahontan	Carson	Earth, power plant	[2] 273, 600	162	5, 400	733, 100	1915
	Lake Tahoe[1]	Truckee	Concrete slab-and-buttress, lake outlet regulator.	[2] 732, 000	16	109	430	[3] 1913
NEVADA-CALIFORNIA								
Truckee River Storage	Boca	Little Truckee	Earth	[2] 40, 900	116	1, 629	911, 900	1939
NEW MEXICO								
Carlsbad	Alamorgodo	Pecos	do	156, 800	148	3, 084	1, 914, 900	1937
	Avalon[1]	do	do	7, 000	58	1, 025	202, 300	[3] 1891
	McMillan	do	do	38, 700	57	2, 114	234, 000	[3] 1894

See footnotes at end of table.

Federal reclamation storage dams, June 30, 1948—Continued

State and project	Name of dam	River	Type	Capacity	Height	Length	Volume	Year
NEW MEXICO-TEXAS								
Rio Grande	Caballo [1]	Rio Grande	Earth	345, 900	112	4, 558	1, 244, 200	1938
	Elephant Butte	do	Concrete gravity, power plant (1940)	[2] 2, 219, 000	301	1, 674	629, 500	1916
NORTH DAKOTA								
Heart River (Missouri Basin)	Heart Butte	Heart River	Earth	450, 000	174	1, 850	1, 222, 000	(4)
OKLAHOMA								
W. C. Austin	Altus [1]	Red, North Fork	Concrete gravity, masonry-faced	[2] 151, 700	110	1, 112	70, 200	1945
OREGON								
Baker	Thief Valley	Powder	Concrete slab-and-buttress	17, 600	73	390	6, 300	1932
Burnt River	Unity	Burnt	Earth	25, 800	83	675	253, 600	1938
Deschutes	Crane Prairie	Deschutes	do	55, 300	36	285	29, 700	1940
	Wickiup	do	do	180, 000	100	13, 860	1, 852, 000	(4)
Umatilla	Cold Springs	Offstream	do	[2] 50, 000	117	3, 450	793, 400	1908
	McKay	McKay Creek	Earth, concrete-faced	[2] 73, 800	180	2, 700	2, 363, 800	1927
Vale	Agency Valley	Malheur, North Fork	Earth	59, 900	110	1, 850	645, 300	1935
	Warm Springs	Malheur, Middle Fork	Concrete arch	192, 400	106	469	19, 500	[3] 1919
OREGON-CALIFORNIA								
Klamath	Clear Lake	Lost	Earth	527, 000	39	840	63, 400	1910
	Gerber	Miller Creek	Concrete arch	[2] 94, 300	88	485	11, 900	1925
	Link River	Link	Concrete slab-and-buttress, lake outlet regulator.	[2] 873, 000	22	435	2, 200	[3] 1921
OREGON-IDAHO								
Owyhee	Owyhee [1]	Owyhee	Concrete arch-gravity	1, 120, 000	417	833	537, 500	1932
SOUTH DAKOTA								
Angostura (Missouri Basin)	Angostura	Cheyenne	Concrete gravity, embankment wing	220, 000	187	1, 818	749, 600	(4)
Belle Fourche	Belle Fourche	Owl Creek	Earth, concrete-faced	[2] 177, 500	122	6, 262	1, 783, 200	1911
Rapid Valley	Dearfield	Castle Creek	Earth	15, 700	133	825	607, 400	1947
TEXAS								
Colorado River	Mansfield	Colorado (Tex.)	Concrete gravity, embankment wings, power plant.[3]	1, 934, 000	278	5, 093	3, 389, 000	1942

UTAH								
Hyrum	Hyrum [1]	Little Bear	Earth	18,800	116	540	435,600	1935
Moon Lake	Midview [1]	Offstream	do	5,800	54	663	138,900	1937
	Moon Lake	Lake Fork, West Fork	do	[2] 35,800	101	1,108	513,100	1938
Newton	Newton	Clarkson Creek	do	5,500	101	3,360	410,000	1946
Ogden River	Pine View	Ogden	do	43,600	103	480	267,700	1937
Provo River	Deer Creek	Provo	do	152,600	235	1,304	2,827,900	1941
Scofield Dam	Scofield	Price	do	73,000	125	575	202,700	1946
Strawberry Valley	Strawberry	Strawberry	do	283,000	79	488	112,700	1913
Weber River	Echo	Weber	do	73,900	158	1,887	1,539,800	1931
WASHINGTON								
Columbia Basin	Grand Coulee	Columbia	Concrete gravity, 2 power plants and pumping plant.	9,517,000	550	4,173	10,585,000	1942
	South Coulee	Offstream	Earth	1,484,000	94	9,800	1,605,000	(4)
	Long Lake	do	do	62,700	130	1,900	1,489,000	(4)
	O'Sullivan	Lower Crab Creek	do	606,000	200	19,000	9,245,000	(4)
Okanogan	Conconully	Salmon Creek	Earth, hydraulic fill	[2] 13,000	70	1,000	359,000	1910
	Salmon Lake	do	Earth	[2] 10,500	42	1,260	194,900	1921
Yakima	Bumping Lake	Bumping	do	37,300	45	3,660	252,600	1910
	Clear Creek	Tieton, North Fork	Concrete arch	[2] 8,500	80	404	5,800	1914
	Cle Elum	Cle Elum	Earth	529,200	160	1,801	1,411,300	1933
	Kachess	Kachess	do	[2] 239,000	114	1,400	199,600	1912
	Keechelus	Yakima	do	170,500	103	6,550	683,500	1917
	Tieton	Tieton	Earth, semihydraulic fill	[2] 197,000	235	920	2,048,600	1925
WYOMING								
Boysen (Missouri Basin)	Boysen	Big Horn	Earth, power plant	1,493,000	220	1,000	1,689,000	(4)
Kendrick	Alcova [1]	North Platte	Earth	190,700	265	763	1,635,300	1938
	Seminoe	do	Concrete arch, power plant	[2] 1,026,000	295	530	210,200	1939
Kortes Power (Missouri Basin)	Kortes [5]	do	Concrete gravity, power plant	4,800	240	440	147,000	(4)
Riverton	Bull Lake	Bull Lake Creek	Earth	[2] 152,000	81	3,456	819,600	1938
	Pilot Butte	Offstream	Earth, semihydraulic fill	[2] 31,600	51	1,300	135,300	1926
WYOMING-MONTANA								
Shoshone	Deaver	do	do	680	14	1,300	30,300	1918
	Ralston	do	do	1,500	35	2,200	24,700	1908
	Buffalo Bill	Shoshone	Concrete arch, power plant	[2] 456,600	325	200	82,900	1910

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[1] Storage and diversion. Classified according to dam's principal feature.
[2] Live storage. Dead storage not evaluated.
[3] Nonreclamation construction.
[4] Under construction. Advance data subject to revision.
[5] Power dam. Water supply for generation of power.

NOTES

Capacity.—Acre feet of reservoir storage provided by highest controlled water surface.
Height.—Feet between lowest point in foundation and normal crest of dam.
Length.—Feet of barrier in dam and integral features constructed between natural abutments.
Volume.—Cubic yards of all material in dam and its appurtenant features.
Year.—Date original construction was completed.

neers visited Sweden, Greece, Italy, Holland, and Venezuela on these services.

The Bureau has been called upon increasingly to supply technical advice to other Government agencies such as the Economic Cooperation Administration, Department of State, and various boundary commissions, for one of which a large dam on the Mexican border was designed.

Operation and Maintenance

The Branch of Operation and Maintenance is concerned with problems of operation on the 58 projects completed by the Bureau, as they pertain to the use of water, maintenance of irrigation systems, the production of crops and livestock, and the general prosperity of the project water users. The Government has a large investment in these projects, and it is of paramount importance that the projects be maintained on a sound financial and economic basis. Problems of repayment, both on the old projects and those under construction, are increasing in importance.

Work has been decentralized as much as possible to regional and local officials who are close to the job, in touch with the water users, and in position to recognize and understand their problems. This decentralized activity includes repayment contract negotiations, operation of distribution systems, and other individual project affairs.

Emphasis is given throughout the work of the Branch of Operation and Maintenance to making irrigation developments of maximum usefulness to the water users. The use of sprinkler systems is being investigated, the conservation of water through lower cost canal linings is being studied, water-measuring devices are urged, and amendatory contracts are being proposed that will recognize actual conditions on the projects.

EXTENSION OF IRRIGATION SERVICE

During the fiscal year, 71,448 acres of new lands on 12 Reclamation projects were brought under initial irrigation by the Bureau. These lands are located as follows:

Columbia Basin project—Pasco unit, Washington	5, 361
Yakima project—Roza division, Washington	5, 098
Deschutes project—north unit, Oregon	6, 500
Boise project—Payette division, Idaho	13, 000
Minidoka project—Hunt unit, Idaho	2, 768
Milk River project—Dodson pumping unit, Montana	994
Missoula Valley project, Montana	2, 100
Rapid Valley project, South Dakota	6, 000
Shoshone project, Heart Mountain Division, Wyoming	3, 676
W. C. Austin project, Oklahoma	13, 850
Tucumcari project, New Mexico	11, 517
Balmorhea project, Texas	584

In addition to these newly developed lands irrigation was extended on some of the older projects, which increased the total irrigated area by nearly 140,000 acres.

OPERATION AND MAINTENANCE OF IRRIGATION SYSTEMS

During the year, the Branch continued its activities relating to irrigation and related reservoir water supply and drainage operations. These operations included the storage, regulation, and distribution of water supplies, together with cooperative relations with other agencies interested in water utilization.

Programs of water conservation, introduced on projects where water was deficient, resulted in the saving of water during the irrigation season and the increasing of project reserves for the next year. Additional drains were constructed to relieve areas of high ground water, and surveys were made to determine the extent and solution of potential drainage problems. A program for the standardization of measuring devices was initiated. The operation and maintenance of the Water Conservation and Utilization projects, except the Buffalo Rapids project, No. 1 Unit, have been transferred to the Bureau of Reclamation. The transfer of the remaining project should be completed next year.

Irrigation water was delivered to the water users during the fiscal year 1948 without a major break in the distribution system of any Bureau-operated project. As money, materials, and labor become available, some of the maintenance and replacement deferred during the war is now being accomplished. On the newer projects, the deferred maintenance can be done as a part of the normal program. On some projects, where the maintenance has been deferred too long, complete rehabilitation is required to place the irrigation facilities in first-class operating condition again. On some projects where the ground water is nearing the surface, additional attention is being given to cleaning, replacing, and extending project drains neglected during the last few years.

CROP PRODUCTION

For the second consecutive year, the gross value of all crops grown in 1947 on lands served by Federal project systems totaled more than a half billion dollars. The total gross value of $555,420,804 was produced on 4,554,352 acres in cultivation on 55 projects, or an average value of $121.95 per acre.

The area capable of being served a full project water supply in 1947 was 2,509,422 acres. In addition, 2,657,361 acres were supplied either a full or supplemental water supply under the terms of the Warren Act or other special water service contracts, making a total of 5,166,-

783 acres for which the Bureau was prepared to supply irrigation water.

On nine project areas where initial irrigation service took place in 1946, the area irrigated was 17,870 acres more in 1947 than during the first year. On the Dodson Pump Unit of the Milk River project in Montana, constructed under the Water Utilization and Conservation Act, 994 acres were irrigated for the first time in 1947.

Crop yields in 1947 were generally below the record 1946 season. This resulted in a decrease of 4.2 percent in total tonnage of crops raised on the Federal reclamation projects, or a total production of food and forage crops of 13,831,618 tons. There was a large increase in tonnage of sugar beets; slight increases in totals for seed crops and cotton; but decreases occurred in tonnages of hay and forage, vegetables and truck, and fruits.

URBAN BENEFITS FROM RECLAMATION PROJECTS

In response to interest expressed by the House Appropriations Committee, an analysis was made during the year of the economic relation between towns and farms on irrigation projects. This showed that the establishment of every irrigated farm upon a project built by the Bureau of Reclamation has resulted in the establishment of two or more families in the towns and villages on these projects. In some instances town populations on projects outnumber farm populations seven or eight to one.

It was estimated that the combined net incomes of about 1,300,000 persons living upon 53 Bureau of Reclamation projects—including both rural and urban populations—averaged more than $1,194,000,000 each year for the 6 years ending in 1946.

REHABILITATION OF OPERATING IRRIGATION PROJECTS

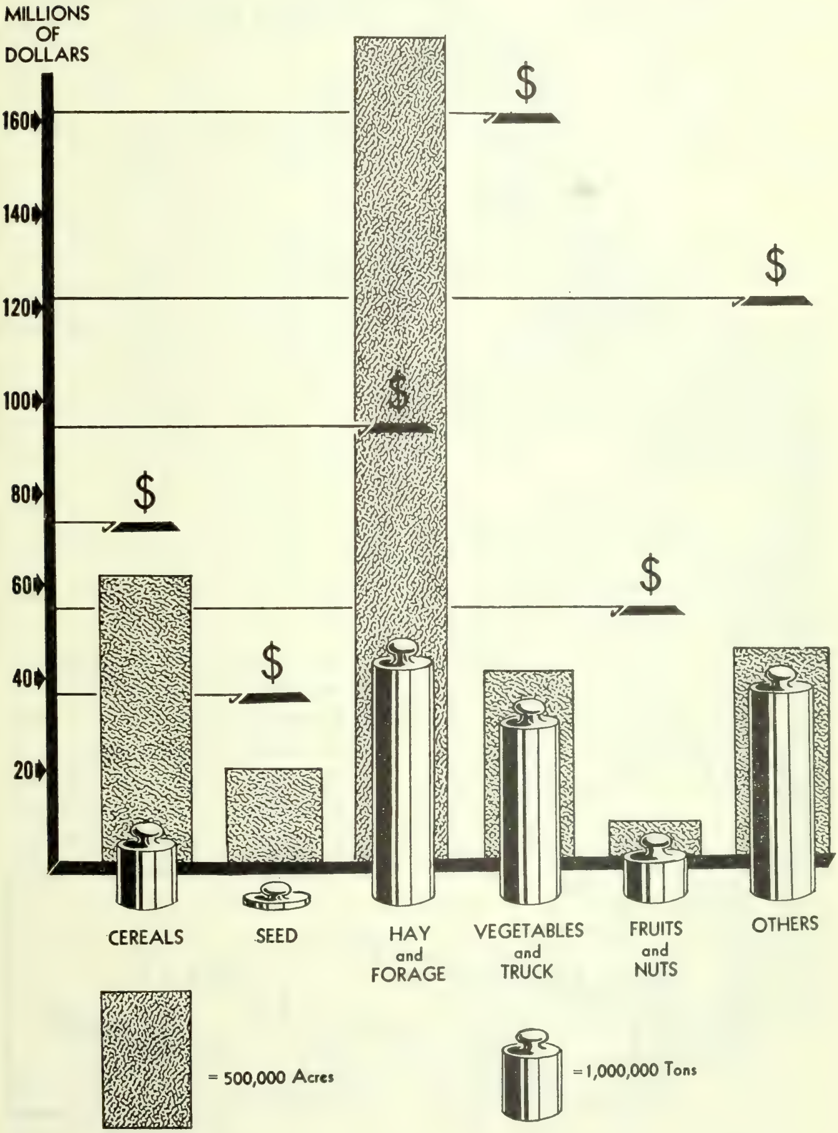
A detailed field survey on all operating projects completed and placed in operation prior to January 1, 1942, indicates that some of the older projects are becoming worn out and extensive rehabilitation is necessary. Some newer projects, where maintenance was deferred during the war, will require rehabilitation to put them in good operating condition. The program this year consisted mostly of expanding maintenance work, continuing the survey as to needs, and planning in detail the rehabilitation program to be started on certain projects in fiscal year 1949.

CANAL LINING PROGRAM

Valuable water is lost from irrigation canals through seepage. A program for investigating low-cost canal linings is under way. This program includes laboratory work in Denver, as well as sections of experimental linings placed in canals, laterals, and farm ditches for

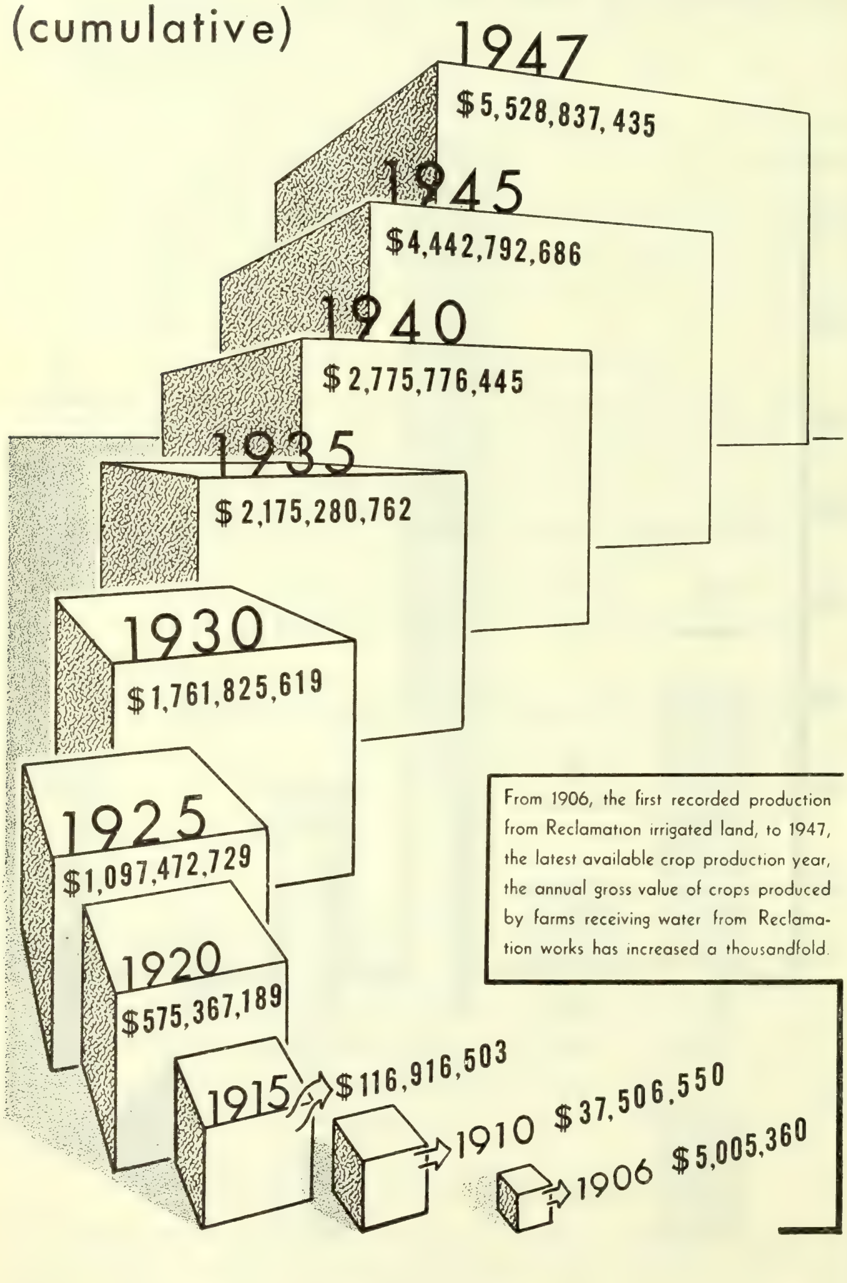
CROP RESULTS

on Federal Reclamation Projects in 1947



CROP VALUES

on Reclamation Projects 1906-47 (cumulative)



From 1906, the first recorded production from Reclamation irrigated land, to 1947, the latest available crop production year, the annual gross value of crops produced by farms receiving water from Reclamation works has increased a thousandfold.

trial under actual field conditions. Reports on the condition of these trial linings were prepared. During the year the resources and experience of State colleges and universities and the Soil Conservation Service were utilized in making cooperative studies.

PUBLIC LAND OPENINGS

There are public lands on some of the reclamation projects which can be opened for settlement under the reclamation homestead laws when irrigation water is made available. Five such public-land openings were conducted during the year. These openings comprised 18,575 irrigable acres of land consisting of 210 farm units. Veterans, under existing law, were given a 90-day preference period in which to apply for homestead units on all openings.

Interest in these openings is illustrated by the fact that over 63,000 persons requested application blanks and 6,832 actually filed applications which was an average of 32 applications per farm unit. On the Klamath project, where the demand for farms was greatest, applications received averaged 91 per farm unit. All applications were examined to determine whether the applicants fully met the requirements established. The names of qualified applicants were then subjected to drawings to establish the priority in which the qualified applicants were awarded farm units.

Most of the veteran homesteaders at the close of the year were building homes and establishing residence on their entries and were beginning to clear, level, and cultivate at least a portion of their land.

Near the end of the fiscal year the availability for sale of the first farm units on the Columbia Basin project was announced. Only three farms were available for sale on the date of the announcement but more will be available under the notice within the next 18 months. While this land, most of which was acquired by the Government, is sold to veterans rather than homesteaded, the qualifications required of purchasers are similar to those required of homesteaders.

Land openings in fiscal year 1948 and those scheduled for 1949 are:

Project	Irrigated farms			
	1948		1949	
	Acreage	Units	Acreage	Units
Riverton	5, 568	55	5, 357	46
Shoshone, Heart Mountain division	3, 215	31	10, 900	89
Yuma	1, 330	26		
Klamath, Tule Lake division	3, 522	44	8, 283	86
Gila, Yuma Mesa division	4, 940	54		
Minidoka, Gooding division			3, 657	46
Boise, Payette division			7, 000	70
Total	18, 575	210	35, 197	337

SETTLER ASSISTANCE

In order that veteran settlers may develop their farm units as rapidly as possible, the Bureau is providing settler assistance in cooperation with other Federal and State agencies. Advice and assistance is offered on the clearing and leveling of the irrigable lands; layout and construction of farm distribution and drainage systems; field lay-out; cropping systems and cultural practices; livestock operations; farm management; credit; and design and construction of farm buildings.

Settler assistance programs were initiated on projects where public land openings were conducted, as well as on other projects where there was need for such assistance. Where several agencies such as State agricultural colleges, vocational education departments, the several agencies of the Department of Agriculture, and the Veterans' Administration were in position to cooperate, programs were laid out for each agency to perform the services it was best able to provide. Where the several agencies were unable to participate in such a program, the Bureau entered into agreement with State Extension Services whereby assistant county agents were employed to give special assistance to settlers on Bureau projects.

As a part of the Bureau's program of assistance to settlers "development farms" have been established in cooperation with State agricultural colleges for the purpose of demonstrating approved irrigation methods and cultural practices. In most cases the State experiment stations have conducted some experimental work on these development farms.

The Bureau also cooperated with State experiment stations and agencies of the Department of Agriculture in conducting experimental work, much of which was conducted on Federal or State experiment station farms.

WEED CONTROL

Special investigations have been made during the past year concerning the water losses and operation and maintenance costs created by weed growths on irrigation distribution and drainage systems and project farms. Increased emphasis has been placed, as a result on determining and initiating more permanent and economical methods of weed control.

Research in cooperation with the Bureau of Plant Industry, Soils and Agricultural Engineering, Department of Agriculture, has resulted in the finding of and adapting new chemical methods for solving these problems. One such method developed in the Bureau's Denver Chemical Laboratory has reduced the cost for chemicals to about one-tenth of those previously used for the control of waterweeds.

These pests often prevent efficient delivery of water, cause excess seepage, necessitate costly dredging of silt deposits and reduce the effectiveness of drains.

The introduction of methods, determined through research, for controlling canal bank weeds and willows has materially reduced maintenance costs and has allowed more extensive control operations. This is resulting in the more effective elimination of these types of weeds which cause operation problems and transpire an estimated million acre-feet of water per year on Federal and private irrigation projects.

The educational weed-control program carried out for the benefit of project farmers through cooperation with Federal, State, and county organizations is resulting in more effective weed-control on croplands. This, in turn, increases farmers' profits and helps protect the Government's investment in Reclamation projects because of the increased repayment ability. In addition to the program for controlling existing weed infestations, special consideration is given to prevention of weed growths, especially on new projects.

The research work, together with a regional weed-control program, is changing weed-control activities from costly, temporary, and haphazard guesswork to an orderly program based on scientific methods.

SOIL AND MOISTURE PROGRAM

The Branch of Operation and Maintenance participates in the Department's soil and moisture conservation program, with particular attention to erosion control and conservation of irrigation water supplies. The Bureau's program was broadened during the past year. Progress in planning and investigation of the need for soil and moisture control on public lands under reclamation withdrawal led to formation of a work program authorized to start in fiscal year 1949.

RECREATIONAL PROGRAMS

Construction of dams for the primary purposes of irrigation and power development provides incidental but very definite benefits to the public through the creation of exceptional recreational opportunities. This is particularly true in the more arid parts of the West where a Bureau of Reclamation reservoir may be the only body of water of any size within hundreds of miles. During the past fiscal year, the Bureau has been working closely with the National Park Service to develop a program for optimum recreational use of all of its existing reservoirs, as well as planning for the projects under construction or still under investigation. As a prerequisite to achievement of such a program, legislation will be required to provide for the expenditure of nonreimbursable funds for recreational development.

SPRINKLER IRRIGATION

Irrigation by means of an overhead sprinkler system may reduce the amount of land leveling required, permit irrigation of steeper slopes without danger of erosion by irrigation water, and induce economy in the use of water where climate and soil conditions are favorable. The progress and development of sprinkler irrigation is being closely watched by the Bureau. A preliminary report on the present status of sprinkler irrigation was prepared by the Branch and circulated for comments. The report will be published next year. Development farms of the Bureau are endeavoring to establish best methods of irrigation by sprinkling in the project areas. In regions 3 and 6, the use of sprinklers as a means of irrigating lands otherwise difficult of reclamation, is being investigated.

AMENDATORY AND NEW REPAYMENT AND WATER SERVICE CONTRACTS

During fiscal year 1948, substantial progress has been made in the negotiation of water service and/or repayment contracts with water users on Reclamation projects. The Reclamation program since its inception in 1902 has depended on the maintenance of the reimbursable features of the Reclamation law.

The new contract program has included negotiation of (1) water service contracts under the provisions of section 9 (e) of the Reclamation Project Act of 1939, (2) repayment contracts under section 9 (d) of the same act or other comparable legal provisions, and/or (3) combination water service and repayment contracts. Under the combination plan, the cost of the distribution system is contracted for repayment under section 9 (d) and water service is provided under section 9 (e), both in the same contract.

In the Central Valley project contract negotiations are under way with 3 public utility districts and 12 irrigation districts. In addition, 7 irrigation districts are considering contracts to build irrigation distribution systems under the provisions of section 9 (d) of the Reclamation Project Act of 1939. The 12 irrigation districts comprise about 530,000 gross acres, of which some 296,000 acres are now irrigated but require supplemental water and 160,000 acres now dry-farmed or undeveloped and will be brought under irrigation for the first time.

With regard to specific Central Valley contracts, an amendatory water-service contract (amending a contract negotiated in 1945), and a new distribution system repayment contract with the Southern San Joaquin Municipal Utility District were executed in May 1948. Voters of the Lindsay-Strathmore Irrigation District in July 1948, by an almost unanimous vote of 188 to 1, authorized district execution of a water-service contract. A water-service contract was negotiated with the Orange Cove Irrigation District and now is before the California District Securities Commission for approval prior to district execution. The Contra Costa County Water District and the Secretary of the Interior approved the form of a joint water service (municipal and irrigation) and distribution system repayment contract; an election by the people of the district to vote on the contract will be held in the fall of 1948. Negotiations were completed with the Lindmore Irrigation District for a combination water service and distribution system contract. A municipal water service contract with the Shasta Dam Area Public Utility District was executed by the district. A similar type of municipal water service contract was approved as to form by the Summit City Public Utility District and the Department and returned for district execution.

On December 31, 1947, the Department executed the 13.5 million-dollar distribution system repayment contract with the Coachella Valley County Water District, All-American Canal System, California. A repayment contract with the Lewiston Orchards Irrigation District was executed in the fall of 1947 providing for the repayment of construction costs of the Lewiston Orchards project, Idaho. A repayment contract with the Arnold Irrigation District, Deschutes project, Oregon, was approved and returned to the district for execution. A combination water service and distribution system repayment contract with the Savage Irrigation District, Missouri Basin project, was approved as to form and returned to the district for execution. Agreement was also reached on the form of a repayment contract with the Conejos Water Conservancy District, San Luis Valley project, Colorado, but district execution is held up pending agreement on Platoro Reservoir flood-control regulations now under discussion with the Corps of Engineers. A repayment contract with the North Fork Water Conservancy District, Paonia project, was approved as to form by the district and the Department and the water users on the project have, by almost unanimous vote, endorsed the contract.

The problem of providing municipal water supplies from Bureau projects, as authorized by the act of 1920, the Reclamation Project Act of 1939, and other acts, added materially to contract activities during the past year. In addition to the municipal water service contracts previously mentioned in the Central Valley, the City of Dickinson, N. Dak., executed a long-term water service contract providing for a municipal water supply from Dickinson Reservoir of the Heart River unit, Missouri Basin project. Negotiations concerning municipal and miscellaneous water supplies also are in progress in connection with the Salt River, Provo River, Gila, Colorado-Big Thompson, Santa

Barbara, Tucumcari, W. C. Austin, Rio Grande, Riverton, and Missouri Basin projects.

The second session of the Eightieth Congress enacted special legislation having a bearing on repayment arrangements of specific projects. P. L. 555, approved by the President on May 25, 1948, authorized the Secretary to execute an amendatory repayment contract with the Northport irrigation district, North Platte project, Nebraska. P. L. 462, relating to the Provo River project, Utah, authorized an extension in the pay-out period to permit the Provo River Water Users' Association and the Metropolitan Water District of Salt Lake City to repay increased cost of project construction. Under this legislation the existing repayment contracts will be retained, but the beginning of payments thereon will be delayed for a few years, during which period a construction component will be included in the annual water rental charge to return above-mentioned increased construction charges. P. L. 629 authorized a pay-out period of 66 years on costs allocated to irrigation on the Kennewick Division of the Yakima project.

Progress has also been made in the negotiation of amendatory contracts on projects in financial difficulty. Proceeding under the authority of the 1939 Reclamation Project Act, the Bureau is investigating the repayment problems of old projects, with a view to negotiation of revised contracts which reasonably protect the interests of both the water users and the United States. Amendatory contracts were executed on behalf of the United States with the Mancos Water Conservancy District, Mancos project, Colorado, in February 1948, and with the Farmers irrigation district, North Platte project, Nebraska, in December 1947. Contracts with the following districts were approved as to form by the Department: Bitter Root Irrigation District, Bitter Root project, Montana; South Ogden Conservation District, Ogden River project, Utah; Shasta View Irrigation District, Klamath project, Oregon; and the Okanogan Irrigation District, Okanogan project, Washington.

FEDERAL INDIVIDUAL INCOME TAX REVENUE

Payment of income taxes constitutes one measure of the benefits of Federal reclamation development. An estimate was prepared during the fiscal year of income taxes paid to the Federal Treasury by individuals living on farms and in towns of Federal Reclamation project areas. The estimated tax revenue from seven selected areas was approximately 66 million dollars for 1947. The return to the Treasury from this form of tax for 1947 and previous years was estimated at about 278 million dollars. Federal construction expenditure through June 30, 1947, for these same projects totals approximately

100 million dollars. On the basis of these estimates the total individual income tax payments to the Federal Treasury from the environs of all Federal Reclamation developments, excluding such areas as the Columbia Basin project in Washington, the Central Valley project in California, and the Missouri Basin project now under construction, approximates 1,100 million dollars.

PAYMENTS TO SCHOOL DISTRICTS

Legislation enacted by the Eightieth Congress provides for payments to school districts for the education of dependents of Government and contractors' employees engaged in construction of Federal Reclamation projects. A survey has been made of the extent of this activity. Based on the estimated number of pupils and the average cost per pupil in the States in which construction will be in progress total payments during fiscal year 1949 were estimated to approximate $1,200,000.

Programs and Finance

Consolidation of programing, budgeting, and financing activities within a single Bureau branch—the Office of Programs and Finance—has produced closer coordination and better correlation of these essential functions. The first full year of operation on the new basis shows that the reorganization effecting the consolidation was administratively advantageous and will lead, when perfected through further experience, to more efficient operation.

The reorganization, effected in Washington at the beginning of the fiscal year, was promulgated to and applied in all regions during the year, with the necessary personnel adjustments. At the close of the year a consolidated programs and finance organization was in operation throughout the Bureau.

The Bureau's construction program is now reflected on a control schedule, which forms the basic administrative control document for all Bureau activities. The control schedule shows dollar requirements by project feature for the current year, the budget year, and the 5 years next following. Thus, for each scheduled activity or project an integrated program is laid out for a 7-year period.

The basis of the control schedule is the authorized objective or objectives of the project, usually stated in terms of acres to be irrigated or power to be developed and the time required for accomplishment. The control schedule is the primary source of budgetary plans and documents which state program determinations in the manner prescribed for budgetary submissions. The budgetary documents are checked against the control schedule and discrepancies reconciled. Common terminology for project features in both documents has increased correlation.

Projects in operation—irrigation and crop value data for the calendar year 1947

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
			Land subject to construction charges			Temporarily suspended lands [2]											
				Crop values							Crop values					Crop values	
	Irrigable area [1]	Irrigated area	Net area in cultivation	Total	Per acre	Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Total	Per acre	Irrigable area	Irrigated area	Net area in cultivation	Total	Per acre
REGION I																	
IDAHO																	
Boise:	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Big Bend Irrigation District (Oregon)	1,721	1,446	1,399	108,283	77.40	47	1,140										
Black Canyon Irrigation District (Notus)	6,872	6,592	6,592	963,950	146.23	0	0										
Black Canyon Irrigation District (Payette)	27,760	21,989	22,086	1,515,826	68.63	0	0										
Boise-Kuna Irrigation District	48,488	44,482	44,582	4,135,506	92.76	100	3,150										
Nampa-Meridian Irrigation District	40,262	34,808	34,706	3,161,620	91.10	187	9,525										
New York Irrigation District	17,826	14,577	14,757	710,330	48.14	0	0										
Settlers Irrigation District	518																
Wilder Irrigation District	56,618	49,328	48,788	6,701,375	137.36	540	20,195										
Totals—Boise project	200,065	173,222	172,910	17,296,890	100.03	874	34,010						125,303	116,550	116,550	12,736,583	109.28
Minidoka:																	
Minidoka Irrigation District	71,875	63,151	63,151	6,503,840	102.99												
Burley Irrigation District	47,937	44,344	44,344	4,712,007	106.26												
American Falls Res. District No. 2	95,589	80,356	80,356	5,381,585	66.97												
Fremont-Madison Irrigation District								103,310	103,310	105,142	9,031,219	85.90					
Totals—Minidoka project	215,401	187,851	187,851	16,597,432	88.35								714,419	674,708	674,708	69,724,225	103.34

Falls Unit[3]	----	----	----	----	----	----	----	3,109	1,100	1,110	67,657	60.95	----	----	----	----
MONTANA																
Bitter Root[4]	16,555	16,193	16,380	658,169	40.18	----	----	----	----	----	----	----	----	----	----	----
Frenchtown	4,935	1,900	2,671	147,424	55.19	----	----	----	----	----	----	----	----	----	----	----
OREGON																
Baker	----	----	----	----	----	----	----	7,312	7,307	7,307	242,664	33.21	----	----	----	----
Burnt River	----	----	----	----	----	----	----	15,291	15,121	15,121	521,034	34.46	----	----	----	----
Deschutes (Central Oregon Irrigation District)	----	----	----	----	----	----	----	43,465	41,465	41,465	5,048,233	121.75	----	----	----	----
Deschutes—North Unit	17,134	13,498	13,498	1,349,420	99.97	----	----	----	----	----	----	----	----	----	----	----
Stanfield	----	----	----	----	----	----	----	6,000	4,930	4,930	276,958	56.18	----	----	----	----
Umatilla:																
East division	10,911	7,965	7,965	328,196	41.20	----	----	----	----	----	----	----	----	----	----	----
West division	7,620	4,635	4,988	179,624	36.01	----	----	----	----	----	----	----	----	----	----	----
Totals—Umatilla project	18,531	12,600	12,953	507,820	39.20	----	----	----	----	----	----	----	1,022	925	920	79,259	86.15
Vale	32,000	30,988	30,988	3,465,373	111.83	----	----									
Westland	----	----	----	----	----	----	----	8,055	4,593	4,644	211,916	45.63	----	----	----	----
OREGON-IDAHO																
Owyhee:																
Advancement Irrigation District	701	645	645	47,576	73.76	0	0	----	----	----	----	----	----	----	----	----
Bench Irrigation District	2,311	2,217	2,219	466,150	210.07	0	0	----	----	----	----	----	----	----	----	----
Crystal Irrigation District	1,263	1,107	1,107	228,989	206.86	0	0	----	----	----	----	----	----	----	----	----
Owyhee Irrigation District	55,686	49,650	49,503	5,684,119	114.82	261	26,941	----	----	----	----	----	----	----	----	----
Payette-Oregon Slope Irrigation District	4,617	4,216	4,223	1,034,309	244.92	0	0	----	----	----	----	----	----	----	----	----
Ontario Nyssa Irrigation District	5,873	5,447	5,455	993,992	182.22	0	0	----	----	----	----	----	----	----	----	----
Gem Irrigation District (Idaho)	31,262	28,876	28,260	3,212,664	113.68	860	40,854	----	----	----	----	----	----	----	----	----
Slide Irrigation District	1,092	1,060	1,070	168,695	157.66	0	0	----	----	----	----	----	----	----	----	----
Totals—Owyhee project	102,805	93,218	92,482	11,836,494	127.99	1,121	67,795	----	----	----	----	----	13,800	13,130	13,130	2,339,195	178.16
WASHINGTON																
Okanogan	5,343	3,762	3,762	1,497,943	398.1	----	----	----	----	----	----	----	----	----	----	----

See footnotes at end of table.

Projects in operation—irrigation and crop value data for the calendar year 1947—Continued

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]		Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
				Total	Per acre												
Yakima:	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Sunnyside Division	103. 579	82, 698	83, 769	15. 912, 792	189. 96	390	20, 584										
Tieton Division	27, 353	24, 620	24, 880	12, 685, 444	509. 87	0	0										
Kittitas Division	69, 552	53, 932	54, 767	3, 513, 203	64. 15	97	776										
Roza Division	44, 735	31, 053	30, 902	7, 715, 837	249. 69	135	22, 469										
Totals—Yakima project	245, 219	192, 303	194, 318	39, 827, 276	204. 96	622	43, 829						191, 602	163, 836	162, 198	31, 851, 311	196. 3
Totals—Region 1	857, 938	725, 535	727, 813	93, 184, 241	128. 03	2, 617	145, 634	186, 542	177, 826	79, 7191	15, 399, 681	85. 69	1, 046, 146	969, 149	967, 506	116, 730, 573	120. 65
REGION 2																	
CALIFORNIA																	
Central Valley													106, 465	131, 550	135, 377	24, 810, 882	183. 27
Orland	19, 796	15, 959	15, 959	1, 565, 962	98. 12												
OREGON-CALIFORNIA																	
Klamath:																	
Main Division (Oregon)	40, 998	33, 255	32, 346	4, 782, 060	147. 84	1, 158	73, 660										
Tule Lake Division (California)	33, 097	31, 642	31, 642	6, 168, 380	194. 94	68	9, 367										
Totals—Klamath project	74, 095	64, 897	63, 988	10, 950, 440	171. 13	1, 226	83, 027						83, 521	68, 924	66, 824	7, 536, 603	112. 78
Totals—Region 2	93, 891	80, 856	79, 947	12, 516, 402	156. 56	1, 226	83, 027						189, 986	200, 474	202, 201	32, 347, 485	159. 98

REGION 3																	
ARIZONA																	
Gila: Yuma Mesa Division	5, 087	4, 648	4, 648	340, 650	73. 29								680	590	590	126, 848	215. 00
Salt River	243, 125	217, 874	228, 475	31, 763, 505	139. 02								137, 428	90, 360	90, 360	11, 945, 124	132. 19
ARIZONA-CALIFORNIA																	
Yuma:																	
Valley Division (Arizona)	50, 390	45, 597	45, 435	12, 600, 027	277. 32	162	7, 690										
Reservation Division (California)	7, 743	2, 128	2, 129	348, 014	163. 46	0	0										
Bard Division (California)	6, 890	5, 720	5, 719	687, 568	120. 23	0	0										
Yuma Auxiliary (Mesa) (Arizona)	3, 925	1, 970	1, 970	285, 572	144. 96	0	0										
Totals—Yuma project	68, 948	55, 415	55, 253	13, 921, 181	251. 95	162	7, 690										
CALIFORNIA																	
All-American Canal: Imperial Irrigation District													523, 000	410, 000	440, 000	77, 055, 259	175. 13
Totals—Region 3	317, 160	277, 937	288, 376	46, 025, 336	159. 60	162	7, 690						661, 108	500, 950	530, 950	89, 127, 231	167. 86
REGION 4																	
COLORADO																	
Fruitgrowers Dam								2, 662	2, 024	2, 024	271, 016	133. 90					
Grand Valley:																	
Gravity Division	30, 443	19, 866	19, 866	1, 895, 488	95. 42												
Orchard Mesa Irrigation District [4]	10, 027	8, 639	8, 639	2, 315, 980	268. 08												
Totals—Grand Valley project	40, 470	28, 505	28, 505	4, 211, 468	147. 74								8, 000	7, 628	7, 628	1, 431, 472	187. 66
Pine River								34, 189	32, 290	32, 397	811, 167	25. 04					
Uncompahgre	92, 190	65, 618	63, 623	4, 725, 724	74. 28	1, 995	97, 584						5, 877	5, 316	5, 316	300, 128	56. 46
NEVADA																	
Humboldt								38, 889	24, 506	29, 956	1, 692, 793	56. 51					
Newlands	69, 100	62, 855	61, 812	2, 900, 954	46. 93	1, 578	33, 789										
Truckee River Storage								28, 811	27, 210	27, 210	1, 981, 740	72. 83					

See footnotes at end of table.

Projects in operation—irrigation and crop value data for the calendar year 1947—Continued

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
			Land subject to construction charges			Temporarily suspended lands [2]											
	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre						Total	Per acre				Total	Per acre
UTAH	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
Hyrum								6, 261	5, 587	55, 698	356, 757	62. 61					
Moon Lake								72, 608	59, 442	9, 681	1, 196, 902	20. 05					
Newton [3]								2, 225	1, 836	12, 036	131, 138	64. 41					
Ogden River								20, 842	15, 392	5, 407	1, 439, 222	93. 41					
Provo River—Deer Creek Division								46, 365	39, 238	39, 544	5, 319, 731	134. 53					
Sanpete:																	
Ephraim Division								6, 700	5, 723	5, 993	200, 975	33. 53					
Spring City Division								6, 017	5, 038	5, 288	219, 078	41. 43					
Totals—Sanpete project								12, 717	10, 761	11, 281	420, 053	37. 24					
Scofield [3]						1, 000	10, 000	15, 609	14, 580	14, 009	786, 133	56. 12					
Strawberry Valley:																	
Highline Division	18, 403	15, 791	16, 143	1, 037, 156	64. 25												
Spanish Fork Division	13, 742	12, 988	13, 164	1, 095, 351	83. 21												
Springville-Mapleton I. D	9, 559	8, 794	8, 881	706, 688	79. 57												
Totals—Strawberry Valley project	41, 704	37, 573	38, 188	2, 839, 195	74. 35								5, 445	5, 146	5, 216	432, 823	82. 98
Weber River (Salt Lake Basin)								91, 725	90, 345	90, 620	16, 778, 928	185. 16					
Totals—Region 4	243, 464	194, 551	192, 128	14, 677, 341	76. 39	4, 573	141, 373	372, 903	323, 211	329, 863	31, 185, 580	94. 54	19, 322	18, 090	18, 160	2, 164, 423	119. 19
REGION 5																	
OKLAHOMA																	
W. C. Austin	9, 600	3, 273	3, 273	344, 788	105. 34												

NEW MEXICO																
Carlsbad	25, 100	21, 545	21, 545	2, 326, 536	107. 98								385	310	310	33, 940	109. 48
Tucumcari	8, 871	4, 563	4, 563	244, 637	53. 61												
NEW MEXICO–TEXAS																	
Rio Grande:																	
Elephant Butte I. D. (New Mexico)	88, 000	90, 829	91, 083	22, 740, 312	254. 54												
El Paso County Water Improvement District No. 1 (Texas)	67, 000	66, 992	67, 069	18, 661, 295	280. 59												
Totals—Rio Grande project [5]	155, 000	157, 821	158, 152	41, 401, 607	261. 78								18, 326	17, 172	17, 172	3, 994, 089	232. 59
Totals—Region 5	198, 571	187, 202	187, 533	44, 317, 568	236. 32								18, 711	17, 482	17, 482	4, 028, 029	230. 41
REGION 6																	
MONTANA																	
Buffalo Rapids:																	
First Division	14, 826	14, 151	14, 151	660, 316	46. 66												
Second Division	8, 100	6, 378	6, 781	197, 773	29. 17												
Totals—Buffalo Rapids project [3]	22, 926	20, 529	20, 932	858, 089	40. 99												
Dodson Pumping Unit [3]	(6)	994	994	57, 107	57. 45												
Huntley	32, 508	24, 052	17, 092	1, 458, 862	85. 35	7, 540	310, 476										
Intake [3]	842	288	288	20, 399	70. 83												
Milk River:																	
Malta Division	56, 652	24, 300	15, 885	800, 972	50. 42	9, 035	163, 272										
Glasgow Division	21, 997	8, 884	9, 711	461, 444	47. 52	611	14, 470										
Chinook Division	43, 484	27, 973	28, 003	1, 834, 755	65. 52	0	0										
Pump Lands	5, 759	4, 765	4, 766	467, 719	98. 14	0	0										
Totals—Milk River project	127, 892	65, 922	58, 365	3, 564, 890	61. 08	9, 646	177, 742										
Sun River:																	
Fort Shaw Division	13, 902	7, 523	8, 288	263, 276	31. 77	193	6, 334										
Greenfields Division	82, 883	67, 489	73, 500	2, 823, 416	38. 41	0	0										
Totals—Sun River project	96, 785	75, 012	81, 788	3, 086, 692	37. 74	193	6, 334										

See footnotes at end of table.

Projects in operation—irrigation and crop value data for the calendar year 1947—Continued

State, project, and subdivisions	Projects entirely constructed by the Bureau							Projects furnished supplemental storage water from works constructed by the Bureau					Special and Warren Act contractors receiving water from Bureau constructed works				
	Irrigable area [1]	Irrigated area	Land subject to construction charges			Temporarily suspended lands [2]											
			Net area in cultivation	Crop values		Net area in cultivation	Total crop values	Irrigable area [1]	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
				Total	Per acre						Total	Per acre				Total	Per acre
MONTANA-NORTH DAKOTA																	
Lower Yellowstone:	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Acres*	*Dollars*	*Dollars*
District No. 1 (Montana)	37,272	32,652	32,652	2,611,260	79.97												
District No. 2 (North Dakota)	19,928	15,793	15,793	1,272,515	80.57												
Totals—Lower Yellowstone project	57,200	48,445	48,445	3,883,775	80.17												
NORTH DAKOTA																	
Buford-Trenton [3]	7,851	6,650	7,688	398,255	51.80												
SOUTH DAKOTA																	
Belle Fourche	72,431	41,186	56,659	2,323,132	41.00												
WYOMING																	
Riverton	42,113	38,460	38,594	2,360,849	61.17								429	429	429	19,773	46.09
Shoshone:																	
Garland Division	41,627	34,343	33,037	2,560,964	77.52	1,306	26,665										
Frannie Division	20,041	12,353	11,760	523,710	44.53	593	19,164										
Willwood Division	11,542	10,620	10,575	737,869	69.77	45	439										
Heart Mountain Division	13,938	3,676	3,676	89,009	24.21	0	0										
Totals—Shoshone project	87,148	60,992	59,048	3,911,552	66.24	1,944	46,268										
Totals—Region 6	547,696	382,530	389,893	21,923,602	56.23	19,323	540,820						429	429	429	19,773	46.09

Mirage Flats [3]	12,000	8,017	8,017	354,663	44.24	------	------	------	------	------	------	------	------	------	------	------	------
NEBRASKA-WYOMING																	
North Platte:																	
Pathfinder Irrigation District	112,943	96,038	77,856	5,094,211	65.43	18,182	273,040	------	------	------	------	------	------	------	------	------	------
Gering & Ft. Laramie Irrig. Dist	54,845	51,896	50,450	4,552,284	90.23	1,446	36,330	------	------	------	------	------	------	------	------	------	------
Goshen Irrigation District (Wyo.)	52,486	45,600	42,889	3,541,325	82.57	2,711	29,669	------	------	------	------	------	------	------	------	------	------
Northport Irrigation District	16,170	10,690	9,321	424,258	45.52	1,369	19,467	------	------	------	------	------	------	------	------	------	------
Totals—North Platte project	236,444	204,224	180,516	13,612,080	75.41	23,708	358,506	------			------	------	139,104	125,401	134,371	10,528,730	78.36
WYOMING																	
Kendrick	2,208	1,957	1,958	53,072	27.11	------	------	------	------	------	------	------	------	------	------	------	------
Totals—Region 7	250,652	214,198	190,491	14,019,815	73.60	23,708	358,506	------	------	------	------	------	139,104	125,401	134,371	10,528,730	78.36
SUMMARY																	
Region 1	857,988	725,535	727,813	93,184,241	128.03	2,617	145,634	186,542	177,826	179,719	15,399,681	85.69	1,046,146	969,149	967,506	116,730,573	120.65
Region 2	93,891	80,856	79,947	12,516,402	156.56	1,226	83,027	0	0	0	0	0	189,986	200,474	202,201	32,347,485	159.98
Region 3	317,160	277,937	288,376	46,025,336	159.60	162	7,690	0	0	0	0	0	661,108	500,950	530,950	89,127,231	167.86
Region 4	243,464	194,551	192,128	14,677,341	76.39	4,573	141,373	372,903	323,211	329,863	31,185,580	94.54	19,322	18,090	18,160	2,164,423	119.19
Region 5	198,571	187,202	187,533	44,317,568	236.32	0	0	0	0	0	0	0	18,711	17,482	17,482	4,028,029	230.41
Region 6	547,696	382,530	389,893	21,923,602	56.23	19,323	540,820	0	0	0	0	0	429	429	429	19,773	46.09
Region 7	250,652	214,198	190,491	14,019,815	73.60	23,708	358,506	0	0	0	0	0	139,104	125,401	134,371	10,528,730	78.36
Totals—Regular projects	2,509,422	2,062,809	2,056,181	246,664,305	119.96	------	------	------	------	------	------	------	------	------	------	------	------
Totals—Storage projects	559,445	501,037	509,582	46,585,261	91.42	------	------	------	------	------	------	------	------	------	------	------	------
Totals—Special and Warren Act Contractors	2,074,806	1,831,975	1,871,099	254,946,244	136.25	------	------	------	------	------	------	------	------	------	------	------	------
Additional areas reported:																	
Temporarily suspended	------	------	51,609	1,277,050	24.74	------	------	------	------	------	------	------	------	------	------	------	------
Leased areas	------	65,881	65,881	5,947,944	90.28	------	------	------	------	------	------	------	------	------	------	------	------
Totals	5,143,673	4,461,702	4,554,352	555,420,804	121.95	------	------	------	------	------	------	------	------	------	------	------	------
Additional irrigable lands, no crop details reported [7]	23,110	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Grand totals	5,166,783	4,461,702	4,554,352	555,420,804	121.95	------	------	------	------	------	------	------	------	------	------	------	------
Grand totals, 1946	5,150,831	4,321,969	4,396,581	530,623,945	120.69	------	------	------	------	------	------	------	------	------	------	------	------
Increase, 1946–1947 totals	15,952	139,733	157,771	24,796,859	1.26	------	------	------	------	------	------	------	------	------	------	------	------

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Note.—Per acre value based on net area in cultivation.

[1] Area for which the Bureau is prepared to supply water.

[2] Generally part of irrigable area but not subject to construction charges until reclaimed.

[3] Water Conservation and Utilization Project.

[4] Private project reconstructed with Govrnment faueds.

[5] Although there are 178,026 acres that can be irrigated within project limits, the area for which there is considered to be a safe and reliable water supply is 155,000 acres.

[6] Included in irrigable acreage of pump lands, Milk River project.

[7] Includes Arnold and Lone Pine Irrigation Districts, Deschutes Project; and Indian Reservation Lands on Pine River Project.

Consolidated statement by projects of construction cost of irrigation and power works, other items reimbursable with construction, and deductions

State and project	Construction cost		Operation and maintenance before public notice (net)		Operation and maintenance deficits, arrearages, and penalties		Construction revenues, contributed funds, and nonreimbursable appropriations (contra)		Abandoned works, nonreimbursable cost, and authorized charge-offs	Net balance	
	Fiscal year 1948	To June 30, 1948	Fiscal year 1948	To June 30, 1948	Fiscal year 1948	To June 30, 1948	Fiscal year 1948	To June 30, 1948		Fiscal year 1948	To June 30, 1948
Arizona:											
Gila	$1,448,666.63	$11,248,278.74	$301,436.60	$243,861.54			[1] $160,790.85	[1] $952,106.05		$1,910,894.08	$12,444,246.33
Salt River		20,244,688.48		115,993.50	[1] $94,723.53	$771,850.39		3,200,814.81	$382,097.31	[1] 94,723.53	17,549,620.25
Yuma auxiliary		902,060.50				590.36	3,451.88	6,221.20		[1] 3,451.88	896,429.66
Arizona-California: Yuma		9,373,406.10		388,934.62		210,434.05	[1] 6,351.72	309,992.39		6,351.72	9,662,782.38
California:											
Central Valley	40,684,754.44	219,705,069.25	225,965.56	387,111.85			22,163.87	405,007.00		40,888,556.13	219,687,174.10
Orland		2,448,669.71		[1] 11,432.99	[1] 1,442.29	60,597.35		28,414.77		[1] 1,442.29	2,469,419.30
Colorado:											
Colorado-Big Thompson	17,097,848.34	51,242,380.90					27,816.91	1,187,608.75		17,070,031.43	50,054,772.15
Fruitgrowers Reservoir		200,740.71						2,500.00			198,240.71
Grand Valley	4,995.61	5,100,617.59		138,621.28		4,529.40	[1] 88.30	275,470.30	812,374.64	5,083.91	4,155,923.33
Paonia	141,140.99	199,243.29								141,140.99	199,243.29
Pine River	5,224.70	3,354,760.82		1,695.72		2,519.44	50.00	2,319.77		5,174.70	3,356,656.21
San Luis Valley	186,245.24	723,557.84								186,245.24	723,557.84
Uncompahgre	40.90	8,976,484.08		311,103.02		196,368.80		25,601.42	1,261,956.28	40.90	8,196,398.20
Idaho:											
Boise	4,369,931.65	29,022,555.07	66,507.37	512,700.14		903,699.42	45,775.91	1,454,674.87	82,393.84	4,390,663.11	28,901,885.92
Boise-Anderson Ranch	3,279,342.07	22,731,140.41	[1] 1,716.40	[1] 8,017.69			4,367.17	23,014.07		3,273,258.50	22,900,108.65
Boise-Payette [2]											
King Hill		1,905,918.80				110,122.51		28,187.27	1,987,854.04		
Lewiston Orchards	365,963.27	365,963.27								365,963.27	365,963.27
Minidoka	378,530.48	23,430,961.04	7,943.89	324,019.63		644,440.26	111,793.34	2,320,471.12	2,288.15	274,681.03	22,076,661.66
Palisades	229,256.32	1,015,943.03					13,126.06	21,381.13		216,130.26	994,561.90
Kansas: Garden City		342,963.68		52,868.10				61,356.82	334,474.96		
Montana:											
Bitter Root		947,641.05				516,637.95					1,464,279.00
Frenchtown		273,603.11		5,496.26							279,099.37
Hungry Horse	1,836,920.30	3,611,469.07					12,119.53	12,202.03		1,824,800.77	3,599,267.04
Huntley		1,559,590 46		[1] 1,000.16		391,067.46	662.04	37,387.26	62,049.83	[1] 662.04	1,850,220.67
Milk River		8,650,943.45	2,972.56	439,735.14		101,062.03	59.94	124,361.28	1,735,969.31	2,912.62	7,331,410.03
Sun River	30,753.02	9,822,106.34		133,102.38		103,137.65		48,555.64	89,650.57	30,753.02	9,920,140.16
Montana-North Dakota: Lower Yellowstone		3,685,433.14	2,097.42			922,893.29	9,475.05	141,037.30	413,828.29	[1] 9,007.43	4,053,460.84

Nebraska-Wyoming: North Platte	18,759.29	19,582,893.13		743,294.42		1,516,486.08	[1] 35,242.20	881,176.12		54,001.49	20,961,497.51
Nevada:											
Humboldt	1,646.09	1,295,387.23		21,020.51			[1] 18,635.67	105,162.06		20,281.76	1,211,245.68
Newlands		7,947,282.86		[1] 2,155.44		44,976.32	7,000.00	59,347.53	4,437,820.00	[1] 7,000.00	3,492,936.21
Truckee Storage		1,093,328.31		9,926.48			[1] 90.00	21,958.30		90.00	1,081,296.49
New Mexico:											
Carlsbad	134.99	3,992,869.61		[1] 17,751.77		93,395.50	439.76	31,065.17	374,883.58	[1] 304.77	3,662,564.59
Hondo		339,491.68		32,952.01				656.03	371,787.66		
Tucumcari	1,286,914.64	12,496,397.18	93,947.01	168,369.45			5,789.91	8,826.42		1,375,071.71	12,655,940.21
New Mexico-Texas: Rio Grande	878,414.87	22,075,408.11		15,771.13		364,531.65	196,633.36	5,148,545.45	357,841.20	681,781.51	16,949,324.24
North Dakota:											
Buford-Trenton		223,423.06		[1] 31.75				1,967.62	221,423.69		
Williston		517,630.09		[1] 165.00				108,370.40	409,094.69		
Oklahoma-W. C. Austin	2,500,855.09	11,007,331.42	72,750.45	70,835.65			22,597.47	1,163,847.47		2,551,008.07	9,974,319.60
Oregon:											
Baker		281,591.64						5,003.00			276,588.64
Burnt River		601,025.82						1,290.82			599,735.00
Deschutes	1,706,798.23	8,725,159.20	19,828.97	56,984.15			57,781.78	58,564.09		1,668,845.42	8,723,579.26
Umatilla		5,240,291.63			[1] 12,601.72	217,515.43	3,874.48	115,176.05	888,340.82	[1] 16,476.20	4,454,290.19
Vale		4,858,906.22		39,773.56	59,755.30	62,782.54	563.60	24,735.89		59,191.70	4,936,726.43
Oregon-California: Klamath	998,334.02	9,531,187.62	[1] 150.00	100,396.12	[1] 1,015.65	84,417.44	436,185.02	3,001,559.94	10,895.22	560,983.35	6.703,546.02
Oregon-Idaho: Owyhee	170,644.59	18,464,687.20				260,923.59	1,779.60	26,006.94		168,864.99	18,699,603.85
South Dakota: Belle Fourche	1,474.71	4,631,866.59		[1] 1,989.03		676,577.53		29,042.05	379,031.58	1,474.71	4,898,381.46
Texas: Valley Gravity Canal and Storage	264,375.59	1,195,113.85					24.00	552.85		264,351.59	1,194,561.00
Utah:											
Hyrum		941,884.54						11,884.54			930,000.00
Moon Lake		1,600,360.94						8,093.18			1,592,267.76
Ogden River	15,498.72	4,419,436.93		2,361.87			450.00	13,336.97		15,048.72	4,408,461.83
Provo River	1,499,833.42	14,711,112.70	[1] 40,014.17	86,622.71			[1] 6,190.53	37,448.26		1,466,009.78	14.587,041.73
Salt Lake Basin		2,725,885.40				5,897.20	30.00	46,445.77		[1] 30.00	2,685,336.83
Sanpete		374,540.34						1,284.40			373,255.94
Strawberry Valley		3,507,423.49		10,744.06		89,635.49	740.00	259,119.12		[1] 740.00	3,348,683.92
Washington:											
Okanogan		1,452,129.45		[1] 47,766.87		26,882.64		7,496.28	997,861.70		425,887.24
Yakima	2,235,232.26	41,712,292.86	34,095.86	210,396.15		150,199.83	44,064.84	881,750.69	4,214.60	2,225,263.28	41,186,923.55
Yakima-Roza [3]											
Wyoming:											
Kendrick	427,420.02	18,676,390.70	43,707.15	198,231.58			555,736.57	2,778,854.52		[1] 84,609.40	16,095,767.76
Riverton	1,621,824.63	8,631,658.21			[1] 1,350.06	90,130.31	3,018.73	36,157.84		1,617,455.84	8,685,630.68
Shoshone	1,987,858.32	17,626,881.24	8,434.65	74,807.77		467,235.44	198,577.07	1,849,177.37	1,545,129.47	1,797,715.90	14,774,617.61
Total	85,675,633.44	691,627,459.18	837,806.92	4,634,174.68	[1] 51,377.95	9,091,537.35	1,558,758.65	25,488,376.29	17,163,261.43	84,901,673.96	662,701,533.49

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[1] Contra.

[2] Combined with Boise in this report.

[3] Combined with Yakima in this report.

Consolidated statement by projects of construction cost of irrigation and power works, other items reimbursable with construction, and deductions—Continued

WATER CONSERVATION AND UTILITY PROJECTS

State and project	Construction cost		Operation and maintenance during construction				Construction revenues (contra)			Net construction cost	
Colorado: Mancos	$604, 283. 14	$1, 449, 530. 52								$604, 283. 14	$1, 449, 530. 52
Idaho:											
Mann Creek	2, 877. 10	35, 713. 85						267. 47		2, 877. 10	35, 446. 38
Rathdrum Prairie	243. 57	363, 945. 88		1, 938. 50				5. 00		243. 57	365, 879. 38
Montana:											
Bitter Root	55. 78	88, 658. 94								55. 78	88, 658. 94
Buffalo Rapids:											
First division	996. 89	2, 005, 409. 00		39, 695. 81				665. 07		996. 89	2, 044, 439. 74
Second division	310, 002. 47	2, 043, 014. 64	717. 60	68, 933. 36			10. 00	10. 00		310, 710. 07	2, 111, 938. 00
Intake	9, 095. 70	92, 371. 46		1, 841. 39						9, 095. 70	94, 212. 85
Milk River: Dodson	21, 404. 64	123, 611. 49								21, 404. 64	123, 611. 49
Missoula Valley	43, 019. 82	252, 627. 48								43, 019. 82	252, 627. 48
Saco Divide	890. 03	3, 368. 00								890. 03	3, 368. 00
Nebraska: Mirage Flats	135, 652. 01	2, 964, 647. 44	[1] 13, 357. 98	[1] 17, 697. 52				495. 00		122, 294. 03	2, 946, 454. 92
North Dakota: Buford-Trenton	89, 619. 11	1, 035, 477. 95								89, 619. 11	1, 035, 477. 95
South Dakota:											
Angostura		43, 484. 62									43, 484. 62
Rapid Valley	58, 926. 80	913, 152. 31					186. 16	2, 053. 32		58, 740. 64	911, 098. 99
Texas: Balmorhea	47, 664. 21	425, 760. 07	7, 969. 11	7, 969. 11				225. 39		55, 633. 32	433, 503. 79
Utah:											
Newton	19, 016. 19	565, 409. 31								19, 016. 19	565, 409. 31
Scofield	34, 603. 56	907, 299. 50	[1] 414. 14	1, 365. 97						34, 189. 42	908, 665. 47
Wyoming: Eden	10, 730. 31	415, 694. 16								10, 730. 31	415, 694. 16
Total	1, 389, 081. 33	13, 729, 176. 62	[1] 5, 085. 41	104, 046. 62			196. 16	3, 721. 25		1, 383, 799. 76	13, 829, 501. 99

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[1] Contra.

SPECIAL PROJECTS

State and project	Construction cost						Contributions			Net balance	
Colorado River Dam Fund:											
All-American Canal	$3,772,879.67	$44,504,010.45					[1] $20,000.00			$3,792,879.67	$44,504,010.45
Boulder Canyon	1,618,217.03	147,712,039.15								1,618,217.03	147,712,039.15
Arizona:											
Davis Dam	13,221,108.23	29,180,909.67								13,221,108.23	29,180,909.67
Parker Dam	7,841.09	6,844,160.41					7,841.09	6,844,160.41			
Parker Power	245,753.95	15,746,247.78								245,753.95	15,746,247.78
Montana: Fort Peck	511,339.87	1,473,495.70								511,339.87	1,473,495.70
Texas: Colorado River	45,505.74	23,950,120.39						9,580.75		45,505.74	23,940,539.64
Washington: Columbia Basin	34,923,287.71	244,389,564.64						3,234,416.88		34,923,287.71	241,155,147.76
Missouri River Basin	24,688,674.78	36,837,209.01					96,297.83	146,297.83		24,592,376.95	36,690,911.18
Total	79,034,608.07	550,637,757.20					84,138.92	10,234,455.87		78,950,469.15	540,403,301.33
Grand total	166,099,322.84	1,255,994,393.00									

[1] Contra.

NOTE.—Construction cost includes work in place only and does not include expenditures made for materials, supplies, and equipment included in inventories at the end of the calendar year and other undistributed items which will eventually be charged to construction cost. Missouri River Basin cost includes preliminary surveys and preconstruction costs.

A preliminary draft of a new finance manual was issued during the year with systematized instructions for finance reporting requirements. The new instructions revised the Bureau usage of the term "obligations" to conform to Budget-Treasury regulation 1. Formerly the Bureau used the term to include only those goods and services received or performed. The revised instructions require the inclusion of all transactions which definitely reserve the appropriation or expenditure, whether or not delivery has been made or the service performed.

During the year steps were taken toward a major revision and overhaul of the Bureau's accounting system. A series of conferences were held with the Bureau of the Budget and the General Accounting Office to determine the method of approach, and the personnel who would be assigned to the work. A general conference of Programs and Finance Office key personnel, including field officials, met in Denver in May and set up 10 committees to study specific phases in developing a modernization of the Bureau's accounting system and related procedures. The committee recommended 31 separate actions to the Director. At the close of the year arrangements had been made for test runs of the revised system in the field and for beginning the drafting of new procedures. This work, long overdue, was accelerated to a considerable extent by congressional criticism of the present system of accounts.

The Denver Finance Division, formerly under the Director of Finance, was transferred to the newly established Office of Programs and Finance, and reorganized to execute more effectively the disbursing, collecting, and accounting work for all Denver offices and branches.

REPORTS

A system of quarterly reports to the Senate and House Appropriations Committees to keep them fully informed on the status of appropriated funds also was developed during the year. A unified reporting system was designed to obtain up-to-date reports on contractors' present and prospective earnings and other obligations under appropriations. The instructions issued for preparing the reports required unification of program and finance functions at the project level where the construction work is performed.

.In the last days of the expiring fiscal year the Interior Department Appropriation Act for 1949, signed June 29, 1948, directed that "no amounts earned under the terms of a contract but remaining unpaid shall be obligated for any purpose, regardless of when such amounts are to be paid." In compliance with this direction, the Bureau immediately ordered project offices to earmark funds in the project accounts for all unpaid retained percentages of construction money, or "hold-backs." In the future, as the unpaid portion of contractors' earnings accrues, funds will likewise be earmarked and set aside for future payment.

New contracts and "prevalidation" forms have been devised to insure the availability of funds to cover contract commitments. Also issued were directions and forms for validating the availability of money to be earned by the contractor and for notifying him of changes in fund status after the contract is in force.

APPROPRIATIONS

The appropriation for 1948 by Congress was $149,136,129, including supplemental sums. With an unused balance of $90,856,328 from the previous year, the money available for reclamation totaled $239,992,457—the largest annual program in the history of the Bureau.

At the end of the fiscal year there was an unobligated 31½ million dollars carried over into fiscal year 1949, accounting for obligations totaling 208.5 million dollars during fiscal year 1948, or 88 percent of construction work performed in 1948 compared with 82 percent accomplished in fiscal year 1947 and 52 percent for fiscal year 1946.

Certain restrictions in the 1948 Appropriation Act handicapped the Bureau during the year in its construction program. One restriction was the termination of construction work by Government forces ("force account" work) except for emergencies and routine minor construction. Although most Reclamation work is done by contract with private construction firms who build according to Bureau design and under the supervision of Bureau engineers, some activities are outside the general contracting field, risks are great, and contractors either are not interested or feel that they must protect themselves by higher bids.

Another restriction was a limitation of $7,800,000 on design work for the projects performed by the Bureau's central design office at Denver. It had the effect of reducing service at a time when construction work was being accelerated. A large part of the design work had to be shifted to the projects which found it difficult to recruit additional experienced personnel to replace the trained engineers laid off in Denver.

Finally, a $50,000 restriction upon expenditures for informational services materially impaired the ability of the Bureau to respond to increased requests for information from the Congress, the press, and the public, resulting from added interest caused by the expanded construction program. The burden of this work fell to a great extent on an overtaxed technical staff and on officers responsible for the prosecution of the construction program, hampering performance of regular work for which they were responsible.

Reclamation construction work in the West was originally financed from the Reclamation Fund, which consisted of money received from the sale of public land supplemented by small loans from the Treasury, and later, oil royalties. In 1916, Congress began to make annual appropriations out of the fund for the work and the Bureau was required to budget its needs for the coming fiscal year's operations and justify the appropriation requested in the same manner as all other Government agencies.

During the year a special compilation of all appropriations and allotments by year was undertaken and was nearly complete at the close of the fiscal year. Another compilation, on feasibility findings, was begun and progress was being made on the third dealing with financial statistical data on all projects since their inception.

The table on page 95 shows the funds made available to the Bureau from its inception to date. From 1902 to 1915 the amounts shown were made available by secretarial action. Subsequent amounts were appropriated by Congress.

On this page appears a table showing the accretions to the Reclamation Fund during the fiscal year, by States.

Accretions to reclamation fund by States

States	Sale of public lands		Proceeds from Oil Leasing Act		Total to June 30, 1948
	Fiscal year 1948	To June 30, 1948	Fiscal year 1948	To June 30, 1948	
Alabama			$97.13	$198,413.15	$198,413.15
Arizona		$2,777,582.75	1,956.94	21,273.40	2,798,856.15
Arkansas			422.23	1,392.70	1,392.70
California		8,334,200.72	2,474,010.42	31,179,674.82	39,513,875.54
Colorado		10,334,498.83	1,114,052.71	3,734,492.27	14,068,991.10
Florida				10.50	10.50
Idaho		7,063,989.01	3,522.96	52,290.36	7,116,279.37
Kansas		1,034,567.12	14,453.81	79,444.39	1,114,011.51
Louisiana			12,206.31	385,881.50	385,881.50
Michigan			778.45	5,692.51	5,692.51
Mississippi			393.23	1,096.31	1,096.31
Montana		15,397,913.87	286,310.76	3,294,964.48	18,692,878.35
Nebraska		2,099,807.84	36.75	519.75	2,100,327.59
Nevada		1,044,523.36	5,532.06	46,006.22	1,090,529.58
New Mexico		6,760,462.76	1,156,787.80	8,902,734.93	15,663,197.69
North Dakota		12,220,117.13	10,168.54	341,421.99	12,561,539.12
Oklahoma		5,932,027.90	3,145.12	24,114.33	5,956,142.23
Oregon		11,998,158.97	687.88	4,474.91	12,002,633.88
South Dakota		7,734,601.03	4,258.19	40,360.70	7,774,961.73
Utah		4,400,914.92	196,948.51	2,104,027.19	6,504,942.11
Washington		7,481,006.83	[1] 3,223.65	46,408.90	7,527,415.73
Wyoming		8,737,917.22	2,574,323.23	51,509,374.52	60,247,291.74
Total		113,352,290.26	7,856,869.38	101,974,069.83	215,326,360.09
Proceeds, Federal water power licenses					[2] 1,096,302.58
Proceeds, potassium royalties and rentals					[3] 3,254,657.94
Receipts from Naval Petroleum reserves, 1920-38, Act of May 9, 1938					29,778,300.23
Proceeds from rights-of-way over withdrawn lands, Act of July 19, 1919					[4] 4,294.79
Grand total					249,459,915.63

[1] Contra.

[2] Proceeds for fiscal year, $32,271.52.

[3] Proceeds for fiscal year, $202,071.91.

[4] Proceeds for fiscal year, $1,071.56.

NOTE.—The data shown above reflect amounts covered into the Reclamation fund prior to fiscal year end closing of Bureau's accounts. Subsequent warrant actions covering fiscal year 1948 accruals to the fund are not included above.

Hearings on the 1949 appropriation for the Bureau in the House required more than a month and a half, extending from March 25 to May 14, and included 33 witnesses from the Bureau of Relamation alone. The printed hearings required 1,878 pages.

In order to insure continued operation of the irrigation and power systems operated and maintained by the Bureau, the Congress approved an emergency fund to take care of unexpected or unusual conditions such as canal bank or generator failures, damage by the elements, and other emergencies.

Allotments from reclamation fund 1902–15, appropriations from reclamation and general funds, 1916–49, and emergency fund allocations (NIRA, PWA, and ERA)

Fiscal year	Allotments from reclamation fund	Appropriations (including revenue authorizations)	Emergency fund allocations	Total
1902	[1] $855,000			[1] $855,000
1903				
1904	[1] 18,200,000			[1] 18,200,000
1905	[1] 8,758,000			[1] 8,758,000
1906	[1] [2] −9,711,173			[1] [2] −9,711,173
1907	[1] 15,211,407	$1,000,000		[1] 16,211,407
1908	[1] 10,011,765			[1] 10,011,765
1909	[1] 10,378,950			[1] 10,378,950
1910	[1] 8,504,050			[1] 8,504,050
1911	24,722,790			24,722,790
1912	7,286,000			7,286,000
1913	6,229,000			6,229,000
1914	9,764,166			9,764,166
1915	11,742,042			11,742,042
1916		13,530,000		13,530,000
1917		8,902,557		8,902,557
1918		8,537,213		8,537,213
1919		9,840,277		9,840,277
1920		7,848,927		7,848,927
1921		9,124,177		9,124,177
1922		20,601,871		20,601,871
1923		15,359,530		15,359,530
1924		12,564,067		12,564,067
1925		13,640,809		13,640,809
1926		12,363,240		12,363,240
1927		7,556,320		7,556,320
1928		12,203,800		12,203,800
1929		14,443,400		14,443,400
1930		8,743,000		8,743,000
1931		20,242,000		20,242,000
1932		22,371,000		22,371,000
1933		25,866,953		25,866,953
1934		11,456,335	$87,205,098	98,661,433
1935		1,176,750	30,523,787	31,700,537
1936		15,438,100	36,883,746	52,321,846
1937		56,444,600	1,646,362	58,090,962
1938		42,417,600	31,089,515	73,507,115
1939		45,410,600	2,376,654	47,787,254
1940		78,165,600	2,715,032	80,880,632
1941		74,533,600	13,514	74,547,114
1942		102,776,031	24,824	102,800,855
1943		91,663,670		91,663,670
1944		41,610,575		41,610,575
1945		27,434,000		27,434,000
1946		120,943,650		120,943,650
1947		119,631,088		119,631,088
1948		143,185,038		143,185,038

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[1] Calendar year.

[2] Negative amount reflects partial invalidation of previous allotments.

HEARINGS

At the request of Senator Sheridan Downey of California, a special committee of the Senate under Senator Kenneth Wherry of Nebraska, Chairman of the Subcommittee on Interior Department Appropriations, held extensive hearings on Bureau policies and fund and accounting procedures. These hearings extended from February 3 to March 13, 1948, and were primarily concerned with the exhaustion of funds for certain features of the Central Valley project in California. In addition to exhaustive testimony by the Commissioner of Reclamation and his staff in Washington, project officials made numerous and extended trips to Washington as witnesses. A large volume of records, correspondence, and accounting documents were compiled for the committee and constituted a major activity of the Office of Programs and Finance for a period of nearly 2 months.

Another House hearing during the year was that conducted by the House Subcommittee on Publicity and Propaganda, which met April 27 to consider charges brought by Senator Downey. On May 14, and before any Department or Bureau witnesses had been heard, the subcommittee recommended to the House Appropriations Committee that the 1949 appropriation bill for Interior contain a rider that the Commissioner, Assistant Commissioners, Regional Directors of Reclamation must be qualified engineers. This recommended rider, somewhat modified, was inserted in the 1949 Appropriation Act.

LONG-RANGE PROGRAM

In response to a request to the Bureau from the chairman of the House Committee on Public Lands, a report on a 7-year long-range program for the development and conservation of land and water resources in the 17 Reclamation States was prepared.

Information for the report had previously been submitted by the regions in accordance with the Commissioner's instructions of August 5, 1947, calling for an examination and detailed report of such resources in each of the seven administrative regions of the Bureau. The information was reviewed, edited, consolidated, and condensed to about 32 printed pages including 13 charts high-lighting present, past, and future aspects of reclamation. Appended to the report was an inventory of projects in operation, under construction, or authorized, and of the projects, divisions and units of projects under investigation in the field that were considered in drawing up the 1948–54 program report.

Comptroller

The Office of the Comptroller was created in the last part of the 1947 fiscal year to provide the Bureau with a financial staff unencumbered by daily line routine, in accordance with congressional recommendations.

Essential functions of the new office were to be consultation service to the Commissioner; final independent review and approval of fiscal procedure and policy; and a systematic audit program.

Preliminary analysis of these functions was completed in the fiscal year 1948 and led directly to a directive defining the scope of the Comptroller's operations and a concrete program.

Notwithstanding the required delays, particularly in the audit system, the Comptroller's office performed a number of important special audits involving verification of financial write-offs incident to land reclassification, settlements, and adjustments in contracts, repayment analyses, and other special features.

The Comptroller also functioned in the important final review phase aiding the Bureau in achieving a more refined fiscal administration. This function may be tangibly evaluated only with difficulty.

Also, the Office of the Comptroller instituted a full-scale audit work program for the ensuing fiscal year. This program involves recurring internal financial audits, examination of books and records of water-user organizations, and continuation of the special audit work already mentioned.

Investigations and Planning

A drastic reduction in the project planning activities of the Bureau was made in fiscal year 1948, because of insufficient appropriations to carry on the contemplated program. In spite of the lack of funds, considerable progress was made on the investigations of some 75 potential projects and on 15 basin or subbasin surveys and a number of planning reports were completed. However, this was possible mainly because of the fact that the investigations for which reports were completed reached an advanced stage and were almost completed in the preceding fiscal year when ample funds were available.

REDUCTION IN THE PLANNING PROGRAM

Only 40 percent of the amount requested in the budget estimate for general investigations in fiscal year 1948 was appropriated by the Congress. Including the carry-over of unobligated funds from fiscal year 1947, approximately $2,625,000, or only 41 percent of the amount actually spent in fiscal year 1947, was available for expenditure in fiscal year 1948.

Considering the General Investigations program and the investigations financed by the Colorado River Development Fund as a single program, the year's program was only 43 percent of what it was in fiscal year 1947.

Thus, personnel had to be reduced and many important investigations had to be stopped because of lack of funds to continue throughout the fiscal year. In making the reduction in forces, as many as possible of the trained technical personnel were retained or temporarily transferred to other work for which they were qualified. Such action was necessary in order that the Bureau retain the competent technical "know-how" that requires so long to develop.

Of some 180 investigations which were under way during fiscal year 1947, more than 100 had to be discontinued in 1948 and deferred until sufficient funds become available for their resumption. A substantial portion of the limited appropriation for this year had to be spent on the unproductive work of "wrapping up" and preserving the volumes of technical data, maps, designs, estimates, and other data on investigations which had to be stopped. In addition to the need to resume many of those investigations, there are continual requests for additional new investigations throughout the West. The entire program of investigations has now been reduced far below the needs of the West and of the Nation for continuation of the inventory of its natural resources and planning their utilization.

COMPREHENSIVE BASIN SURVEY REPORTS

The review of the comprehensive report on the Columbia River Basin by the affected States and the Secretary of the Army was completed and at the end of the year the report was submitted to the President.

The inventory report on the Colorado River Basin, previously completed and reviewed by the affected States, was submitted to the Congress and published as House Document 419, Eightieth Congress.

A report on the Nueces River Basin in Texas was completed and submitted to the Congress. The report does not recommend any construction at this time.

A revised report on the Central Valley Basin, California, was completed and was reviewed by the State. At the close of the fiscal year, the report was ready for submission to the President.

NEW PROJECTS AUTHORIZED

Planning reports were completed on the Preston Bench project in Idaho and the Middle Rio Grande project in New Mexico, which were authorized for construction by the Congress. The Congress also authorized the construction of the Kennewick Division of the Yakima project, Washington. Also reports were completed on the Hayden Lake unit of the Rathdrum Prairie project, Idaho, and the Cachuma unit of the Santa Barbara County project, California, and these projects were authorized for construction by a finding of feasibility by the Secretary of the Interior under the provisions of the Reclamation Project Act of 1939.

OTHER PLANNING REPORTS

A report on the Gooseberry project, Utah, was completed and submitted to the Congress. This report does not recommend construction of the project at this time.

The report on the central Arizona project, Arizona, New Mexico, and Utah, was reviewed by the affected States and Federal agencies and submitted to the President. The report on the Rio Grande project power system extension (Velarde steam plant) was submitted to the President.

At the end of the fiscal year, the following reports were before the affected States and Federal agencies for official review:

The Dalles project, west unit, Oregon.
Hells Canyon project, Idaho, Oregon.
Solano County project, California.
Chino Valley project, Arizona.
Snowflake project, Arizona.
Emery County project, Utah.

Preliminary drafts of the following additional reports were received in Washington and were in various stages of processing at the close of the fiscal year:

Canton project, Oklahoma.
Hammond project, New Mexico.
Hassayampa project, Arizona.
Valley Gravity project, Texas.
North Fork Kings River Power Development, California.
Jensen project, Utah.
Lyman project, Wyoming.
Vermejo project, New Mexico.
Minnesota unit, Paonia project, Colorado.

Reports were completed for the Cambridge Bench project, Idaho, and the Canby project, Oregon, which are being held as supplemental reports supporting the report on the Columbia River Basin.

RIVER COMPACTS

Further development of water resources in the Upper Colorado River Basin has been awaiting the agreement between the Upper Basin States on the division of the waters of the Upper Colorado River system. At the end of the fiscal year, prospects for the early completion of the negotiation of a compact to divide the waters of the Upper Colorado River system between the Upper Basin States were very favorable. The Chief of the Division of Hydrology of the

Branch of Project Planning acted as chairman of the engineering committee advising the compact commissioners. The division of Hydrology made water studies and supplied engineering data to the commissioners who were negotiating throughout the year.

A water compact is also under negotiation between the States of the Arkansas River Basin. The Director of the Branch of Project Planning testified for the Department before the Arkansas River Compact Commission.

HYDROLOGY

Sedimentation studies were made by the sedimentation section of the Division of Hydrology of the Branch of Project Planning in connection with specific investigations; particularly the Middle Rio Grande project in New Mexico, the Canton project in Oklahoma, the Valley Gravity project in Texas, and the Lower Platte River Basin in Nebraska. Surveys were made of Altus, Arrowrock, Lake Ericson, and Balmorhea Reservoirs. A survey of Lake Mead is in progress. A comprehensive program for securing basic information for sediment control in streams, canals, and reservoirs was prepared in cooperation with the technical staff of the Chief Engineer. Laboratory facilities were utilized in studying specific sediment problems. Sedimentation specialists were added to the Project Planning staffs of regions V, VI, and VII to direct and coordinate the work in those regions.

The research being conducted by the Army, Navy, and Weather Bureau on artificial precipitation was studied by the Bureau of Reclamation. Liaison on this work with those agencies was established and provisions were made by which the Bureau will keep abreast of the research of those agencies and if necessary, participate to the extent of the interests of Reclamation.

INTERNATIONAL INVESTIGATIONS

As a result of negotiations between Canada and the United States, the two governments jointly sent a reference to the International Joint Commission requesting that a study and advisory findings be made of the present and future uses, and apportionments between the two countries, of certain international streams between the continental divide on the west to and including the Red River of the North on the east. International engineering boards, with their field engineering committees, which include representatives of the Bureau of Reclamation, were established under the International Joint Commission. Investigational work was initiated during the later part of the year.

Bureau of Reclamation engineers participated in the international investigations of the Columbia River and its tributaries.

During the year negotiations were in progress with the International

Boundary and Water Commission (United States and Mexico) in connection with development of final plans for a canal to serve irrigation water to the Lower Rio Grande Valley under the Valley Gravity project.

ORGANIZATION

The basic organization structure of the Bureau remained unchanged during the year. Within it a number of field design units were created to facilitate the rapid decentralization of the less complicated engineering and design functions previously performed in Denver. Also, additional district offices were established in regions VI and VII as another step in the orderly development of project-type organizations with qualified staffs at the work site which will achieve effective cooperation with water and power users and facilitate more efficient integrated river basin and subbasin resources development.

MANUAL OF INSTRUCTIONS

More than 80 percent of the Bureau's manual has been completed and is undergoing its initial application and review by the field personnel. This manual will encompass all policy and procedural instructions, methods and standards for carrying out the Bureau program from project investigations, design and construction through the operating stage as well as instructions in the administrative services fields. Extensive revisions of this material are expected to be made during the next year based upon field experience.

REPORTS CONTROL AND COORDINATION

In the fall of 1947 a comprehensive Bureau program of reports analysis and coordination was undertaken and major results have already been achieved. Through a cooperative program involving the regional and field personnel as well as the Commissioner's staff this program will be extended to a complete evaluation of all reporting requirements and procedures.

ADMINISTRATIVE REVIEW PROGRAM

An administrative review program was inaugurated on a limited scale during the year. All of the phases of each of the major functions of the Bureau being performed in the Washington, regional, and field offices will be reviewed and recommendations developed for the improvement of future operations. This program is viewed as a continuing primary staff responsibility of each of the branches and offices with management personnel participating to coordinate the review of individual functions and to assist in resolving problems which involve the functions of more than one branch or office.

Personnel

Congressional limitations on personnel administration compelled elimination of as much routine record-keeping as possible and concentration by the small staff of personnel officers remaining in the Bureau on planning and advising administrators and supervisors in the management and supervision of personnel.

A major contribution was the completion of the personnel portion of the Bureau of Reclamation Manual. Upon its completion it was possible to eliminate over 1,000 Bureau circulars, orders, and instructions issued during the past 10 years, as well as innumerable letters and other miscellaneous instructions. Particular attention was given in the manual to the expression of over-all policies on personnel administration and the adoption of procedures through which these policies may be accomplished. Classification of Bureau positions achieved greater uniformity during the year by the promulgation of a large number of standard position descriptions. Position classification officers of the Bureau worked with representatives of the Civil Service Commission in developing new specifications for certain series of professional and administrative positions.

In focusing attention upon personnel administration in the Bureau of Reclamation full consideration must be given to the geographical distribution of the Bureau's program as well as the diversity and complexity of the work being performed. The Bureau is administered on a decentralized basis, with the offices of the Commissioner located in Washington, D. C., and Denver, Colo.; 7 Regional Offices and 130 individual projects and offices operating within the 17 Western States. On June 30, 1948, there were in the Bureau 17,035 employees, 12,015 of whom were under the Classification Act, 4,944 under the wage boards, and 76 on other types of appointments. Of this number 8,467 were veterans.

Long-range planning for attracting and retaining the best qualified employees in the Bureau were concentrated this year in the employment and training of 450 engineer trainees recruited from colleges and universities throughout the country. The idea for the engineer trainee program started 2 years ago through normal civil-service channels and the eventual announcement of a civil-service examination by the central board of civil-service examiners for the Bureau of Reclamation. Special recruitment teams consisting of Bureau engineers and personnel officers visited numerous colleges and universities to outline the opportunities for engineer trainees and junior engineers in the Bureau. A booklet on Bureau activities, especially designed for the use of prospective applicants, was printed in color by the Government Printing Office. The success of these recruiting teams and the distribution of this booklet is borne out by the large number of applicants who applied for the civil-service examinations and the number of eligibles that were selected by Bureau officials.

The central board of civil-service examiners certified 10,587 applicants for professional and subprofessional engineering and technical positions in the Bureau from which 1,373 individuals received appointments and 771 employees received conversions to competitive status.

Staff guidance was furnished to operating officials throughout the Bureau in the conduct of training programs for engineer trainees, engineering aides, engineering draftsmen, concrete and materials inspectors, powerhouse operators, as well as apprentice programs for employees engaged in the crafts and trades. Cooperative work and training programs were also developed with certain colleges and universities and wherever practicable employees of the Bureau were given the opportunity to work and study. The training and apprentice programs were designed to achieve the maximum utilization of the skills and abilities of all employees in such a manner as to provide trained employees for the accomplishment of present and future reclamation construction and operation projects at the minimum cost for the work to be done.

Important changes in key personnel included the retirement on June 30 of Chief Engineer Walker R. Young and the appointment of L. N. McClellan as his successor effective July 1. Dring the year the Office of the Comptroller was established and the Offices of Progress Control and Finance were combined into the Office of Programs and Finance. William F. Kubach was appointed Comptroller and Alfred R. Golze, Director of Programs and Finance.

Power Utilization

The Bureau of Reclamation, during the early stages of western reclamation development, constructed a number of power plants on reclamation projects primarily to supply power for project construction, irrigation pumping, and other incidental project uses. Surplus power, not required for such uses, was made available to adjacent towns and to other customers under provisions of the act of August 16, 1906 (ch. 1631, 34 Stat. 116). With the enactment of the Boulder Canyon Project Act of 1928 and the subsequent construction of Hoover Dam (formerly known as Boulder Dam) and power plant, a new and more important phase of reclamation development came into existence.

The dominant factor which made the Boulder Canyon project possible, as well as a large number of projects now under construction, was the provision for an adequate return from power revenues to finance the repayment of a major portion of the construction costs. Projects which are now under construction, such as the Columbia Basin, Central Valley, Colorado-Big Thompson, and Missouri River Basin projects, to name a few, would not have been considered economically feasible or desirable without power development as an integral component. In some instances power revenues must contribute as much as 75 percent or more of the total cost of irrigation facilities, in addition to the repayment of costs allocated for power purposes. Although irrigation development is the dominant objective, adequate power revenues have been a prerequisite to the development of the major projects which have been initiated since 1928, and this will also be true of future major projects.

Power developments on reclamation projects have an added significance in the development of the West. Experience in the last year indicates that restriction in industrial, rural, and municipal development must take place unless added generating and transmission facilities are constructed to meet unprecedented needs for power. California, especially in the Central Valley, experienced one of the most severe power shortages in its history during the spring of 1948. The rapid growth of industries in the Pacific Northwest has currently placed an added burden on already overloaded generating capacity. Increased uses of power for irrigation pumping in the Southwest and especially in the State of Arizona, have made this one of the severe power shortage areas. In the Missouri Basin, increased power requirements for the expanding oil industry, rural and municipal loads, and for project and private irrigation pumping have overloaded existing power generating and transmission facilities.

These continually increasing demands cannot be met by the installation of additional fuel-burning generating capacity without placing heavy demands on our dwindling reserves of fuel oil. Tremendous increases in the use of fuel oils have already resulted from increased population and industrial activities in the West. The logical source of increased power production is from the undeveloped water resources of the many streams and rivers in the Western States. Many of these developments can be developed as components of multipurpose projects constructed to conserve water resources for irrigation, navigation, and flood control.

The demand for power during the past few years has increased so rapidly that additional fuel and hydro-generating capacity being installed cannot keep up with the rapid increases in central California, the Southwest, and New Mexico areas and in the Missouri Basin. In some areas fuel generating capacity is being installed to meet the increases. Without the development of hydro-generating capacity, fuel-generating capacity must be developed to meet the needs. It has been estimated that if fuel oil were required to produce the 15,256,000,000 kilowatt-hours generated at 16 hydroelectric plants operated by the Bureau of Reclamation, it would require a consumption of approximately 40,000,000 barrels of fuel oil. This is an example of the savings in critical national resources made through the use of hydro power.

The Bureau of Reclamation's construction program has always been based on the conservation of this natural resource for the expansion of highly profitable agricultural development and for production of power to further the advancement of rural electrification, irrigation pumping, and industrial expansion for stabilization of western economy.

PRESENT INSTALLED CAPACITY

During the period from the beginning of reclamation in 1902 until June 30, 1948, 33 power plants with a total installed capacity of 2,637,987 kilowatts have been placed in operation on reclamation projects. The Bureau of Reclamation operates and maintains 16 of these power plants with a total installed capacity of 2,494,400 kilowatts on 14 projects. The increase of 414,000-kilowatt capacity during fiscal year 1948 resulted from the addition of three 108,000-kilowatt units at Grand Coulee power plant on the Columbia Basin project, a 75,000-kilowatt unit at the Shasta power plant on the Central Valley project, and 15,000 kilowatts at the Army's Fort Peck plant.

A total of 16 power plants, which are operated by others, have been constructed on reclamation projects. Nine of these power plants with an installed capacity of 30,687 kilowatts were constructed by the Bureau of Reclamation and seven with an installed capacity of 62,900 kilowatts were constructed by others.

The Fort Peck power plant, constructed and operated by the Corps of Engineers, has an installed capacity of 50,000 kilowatts. The Bureau of Reclamation, under provisions of the Fort Peck Act of 1938, has the responsibility for marketing power not required for project use.

ADDITIONAL CAPACITY UNDER CONSTRUCTION

The Bureau of Reclamation has in various stages of construction 11 new power plants with an ultimate capacity of 838,600 kilowatts. Additional units being installed in plants now operating total 1,297,000 kilowatts, bringing the total capacity under construction to 2,135,600 kilowatts. Preparations are being made to install two additional 82,500-kilowatt units at the Hoover power plant on the Boulder Canyon project. Two additional units of 75,000-kilowatt capacity each are being installed at Shasta power plant on the Central Valley project, and nine main generating units of 108,000-kilowatts capacity and one station service unit of 10,000-kilowatt capacity are in various stages of preparation for installation at the Grand Coulee power plant on the Columbia Basin project. Fabrication of an additional unit of 35,000-kilowatt capacity for installation by the Corps of Engineers at the Fort Peck power plant is to be started next year. Other power plants in various stages of construction but not in operating status are shown on table 1.

TABLE 1.—*Hydroelectric plants on reclamation projects, operating, under construction, or authorized as of June 30, 1948*

A. CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

1 State	2 Project	3 Name of plant	4 Year of initial operation	5 Present name plate capacity (kilowatts)	6 Ultimate name plate capacity (kilowatts)	7 Present number of generators and capacities (kilowatts)	8 Ultimate number of generators and capacities (kilowatts)
1. Arizona-Nevada	Boulder Canyon	Hoover [1]	1936	1, 034, 800	1, 322, 300	12–82,500; 1–40,000; 2–2,400	15–82,500; 2–40,000; 2–2,400.
2. Arizona-California.	Parker	Parker	1942	120, 000	120, 000	4–30,000	4–30,000.
3. California	Central Valley	Shasta	1944	229, 000	379, 000	3–75,000; 2–2,000	5–75,000; 2–2,000.
4. California	Yuma	Siphon Drop	1926	1, 600	1, 600	2–800	2–800.
5. Colorado	Colorado-Big Thompson	Green Mountain	1943	21, 600	21, 600	2–10,800	2–10,800.
6. Idaho	Boise	Boise Diversion	1912	1, 500	1, 500	3–500	3–500.
7. Idaho	do	Black Canyon	1925	8, 000	8, 000	2–4,000	2–4,000.
8. Idaho	Minidoka	Minidoka	1909	13, 400	13, 400	1–5,000; 1–2,400; 5–1,200	1–5,000; 1–2,400; 5–1,200.
9. Wyoming	North Platte	Guernsey	1927	4, 800	4, 800	2–2,400	2–2,400.
10. Wyoming	do	Lingle	1919	1, 400	1, 400	2–400; 2–300	2–400; 2–300.
11. New Mexico	Rio Grande	Elephant Butte	1940	24, 300	24, 300	3–8,100	3–8,100.
12. Washington	Columbia Basin	Grande Coulee [2] [3]	1941	992, 000	1, 974, 000	9–108,000 [3]; 2–10,000	18–108,000 [3]; 3–10,000.
13. Washington	Yakima	Prosser	1932	2, 400	2, 400	1–2,400	1–2,400.
14. Wyoming	Kendrick	Semineo	1939	32, 400	32, 400	3–10,800	3–10,800.
15. Wyoming	Riverton	Pilot Butte	1925	1, 600	1, 600	2–800	2–800.
16. Wyoming	Shoshone	Shoshone	1922	5, 600	5, 600	1–4,000; 2–800	1–4,000; 2–800.
		Subtotal A		2, 494, 400	3, 913, 900		

B. CONSTRUCTED BY BUREAU OF RECLAMATION; OPERATED BY OTHERS

1 State	2 Project	3 Name of plant	4 Year of initial operation	5 Present name plate capacity (kilowatts)	6 Ultimate name plate capacity (kilowatts)	7 Present number of generators and capacities (kilowatts)	8 Ultimate number of generators and capacities (kilowatts)
1. Arizona	Salt River	Roosevelt	1909	15, 400	15, 400	5–1,080; 1–4,000; 1–6,000	5–1,080; 1–4,000; 1–6,000.
2. Arizona	do	Arizona Falls [4]	1913	850	850	2–425	2–425.
3. Arizona	do	Cross Cut [4]	1914	5, 100	5, 100	1–3,000; 3–700	1–3,000; 3–700.
4. Arizona	do	S. Consolidated [4]	1912	1, 600	1, 600	2–800	2–800.
5. Colorado	Grand Valley	Grand Valley (Palisades)	1932	3, 000	3, 000	2–1,500	2–1,500.
6. Nevada	Newlands	Lahontan	1911	1, 500	1, 500	3–500	3–500.
7. Oregon	Deschutes	Cove [5]	1946	1, 500	1, 500	1–1,500	1–1,500.
8. Utah	Strawberry Valley	Spanish Fork [6]	1908	1, 550	1, 550	2–450; 1–250; 1–400	2–450; 1–250; 1–400.
9. Washington	Yakima	Rocky Ford	1916	187	187	1–187	1–187.
		Subtotal B		30, 687	30, 687		

C. CONSTRUCTED AND OPERATED BY WATER USERS ORGANIZATIONS

1. Arizona	Salt River	Chandler[7]	1919	600	600	1-600	1-600.
2. Arizona	do	Horse Mesa[7]	1927	30,000	30,000	3-10,000	3-10,000.
3. Arizona	do	Mormon Flat[7]	1926	7,000	7,000	1-7,000	1-7,000.
4. Arizona	do	Stewart Mountain[7]	1930	10,400	10,400	1-10,400	1-10,400.
5. California	All American	Drop No. 3[8]	1941	4,800	9,600	1-4,800	2-4,800.
6. California	do	Drop No. 4[8]	1941	9,600	19,200	1-9,600	2-9,600.
7. Oregon	Klamath	"C" Canal Drop[9]	1938	500	500	1-500	1-500.
		Subtotal C		62,900	77,300		

D. CONSTRUCTED AND OPERATED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER MARKETED BY BUREAU OF RECLAMATION

1. Montana	Fort Peck	Fort Peck	1943	50,000	85,000	1-35,000; 1-15,000	2-35,000; 1-15,000.
		Subtotal D		50,000	85,000		

E. UNDER CONSTRUCTION BY BUREAU OF RECLAMATION[13]

1. Arizona-Nevada	Davis	Davis	1950	0	225,000	0	5-45,000.
2. California	Central Valley	Keswick	1949	0	75,000	0	3-25,000.
3. Colorado	Colorado-Big Thompson	Estes	1950	0	45,000	0	3-15,000.
4. Colorado	do	Marys Lake	1950	0	8,100	0	1-8,100.
5. Idaho	Boise	Anderson Ranch	[10] 1950	0	[11] 40,500	0	3-13,500.
6. Idaho	Palisades	Palisades	1954	0	54,000	0	3-18,000.
7. Montana	Missouri Basin	Canyon Ferry[12]		0	50,000	0	3-16,667.
8. Montana	Hungry Horse	Hungry Horse	1952	0	285,000	0	4-71,250.
9. Wyoming	Missouri Basin	Boysen	1952	0	15,000	0	2-7,500.
10. Wyoming	do	Kortes	1950	0	36,000	0	3-12,000.
11. Wyoming	Shoshone	Heart Mountain	1948	0	5,000	0	1-5,000.
		Subtotal E		0	838,600		

F. UNDER CONSTRUCTION BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION

1. North Dakota	Missouri Basin	Garrison	1954	0	320,000	0	5-64,000.
2. South Dakota	do	Fort Randall	1954	0	320,000	0	8-40,000.
		Subtotal F		0	640,000		

See footnotes at end of table.

TABLE 1.—*Hydroelectric plants on reclamation projects, operating, under construction or authorized as of June 30, 1948*—Continued

G. AUTHORIZED TO BE CONSTRUCTED BY BUREAU OF RECLAMATION [13]

1 State	2 Project	3 Name of plant	4 Year of initial operation	5 Present name plate capacity (kilowatts)	6 Ultimate name plate capacity (kilowatts)	7 Present number of generators and capacities (kilowatts)	8 Ultimate number of generators and capacities (kilowatts)
1. Colorado	Colorado-Big Thompson	Quillan	1952	0	28,500	0	3-9,500.
2. Colorado	do	Cottonwood	1952	0	11,500	0	2-5,750.
3. Colorado	do	Rattlesnake	1952	0	13,500	0	2-6,750.
4. Colorado	do	Flatiron	1952	0	41,000	0	3-7,000; 2-10,000.
5. Colorado	do	Big Thompson	1952	0	6,700	0	1-6,700.
6. Montana	Missouri Basin	Lower Marias		0	1,600	0	2-800.
7. Montana	do	Mission		0	50,000	0	3-16,667.
8. Montana	do	Yellowtail	1953	0	120,000	0	4-30,000.
9. Nebraska	do	Harlan		0	1,200	0	1-1,200.
10. North Dakota	do	Crosby [14]		0	70,000	0	4-17,500.
11. North Dakota	do	Des Lacs [14]		0	70,000	0	4-17,500.
12. South Dakota	do	Miller Drop [14]		0	180,000	0	4-45,000.
13. Washington	Yakima-Rosa Division	Yakima Ridge	1950	0	10,000	0	2-5,000.
14. Washington	Yakima-Rosa	Chandler	1951	0	12,000	0	2-6,000.
15. Wyoming	Missouri Basin	Tongue River		0	25,000	0	2-12,500.
		Subtotal G		0	641,000		

H. AUTHORIZED TO BE CONSTRUCTED BY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY; POWER TO BE MARKETED BY BUREAU OF RECLAMATION

1 State	2 Project	3 Name of plant	4 Year of initial operation	5 Present name plate capacity (kilowatts)	6 Ultimate name plate capacity (kilowatts)	7 Present number of generators and capacities (kilowatts)	8 Ultimate number of generators and capacities (kilowatts)
1. South Dakota	Missouri Basin	Big Bend	1956	0	120,000	0	6-20,000.
2. South Dakota	do	Gavins Point	1954	0	24,000	0	3-8,000.
3. South Dakota	do	Oahe	1955	0	490,000	0	7-70,000.
		Subtotal H		0	634,000		
Total (from this tabulation).				2,637,987	6,860,487		
Total with Grand Coulee units figured at 120,000 kilowatts).				2,743,987	7,076,487		

FOOTNOTES

[1] Power plant units operated by power allottees under agency contract.

[2] Power marketed by Bonneville Power Administration.

[3] Main units with a name plate rating at 108,000 kilowatts have continuous operating capacity of 120,000 kilowatts.

[4] Power plant constructed by Bureau of Reclamation with Salt River Valley Water Users' Association funds.

[5] Unit No. 3 installed in Pacific Power & Light Co.'s plant.

[6] 3 plants: (*a*) Spanish Fork (upper); (*b*) Spanish Fork (lower); (*c*) Payson.

[7] Constructed and operated by Salt River Valley Water Users' Association.

[8] Constructed and operated by Imperial Irrigation District.

[9] Constructed and operated by Enterprise Irrigation District.

[10] First 2 units completed.

[11] 27,000 kilowatts presently authorized.

[12] Subject to limiting provisions contained in Public Law 841, 80th Cong., 2d sess.

[13] Includes power plants in first stage of construction of Missouri Basin project and Miller power plant of Oahe-James River Unit.

[14] Seasonal output to be used for irrigation pumping.

Additional authorized plants not under construction will have a total installed capacity of 641,000 kilowatts in 15 power plants. Power plants under construction by the Corps of Engineers from which the Bureau of Reclamation will market power under the provisions of the Flood Control Act of 1944, total 640,000 kilowatts. These power plants are located at Garrison and Fort Randall Dams on the Missouri River with each power plant having an installed capacity of 320,000 kilowatts. Additional power plants authorized but not under construction by the Corps of Engineers will total 634,000 kilowatts in three plants on the Missouri River.

A summary of the hydroelectric plants on Reclamation projects operating, under construction or authorized as of June 30, 1948, is shown on table 1.

At the close of the fiscal year the Bureau of Reclamation had approximately 2,800 miles of high-voltage transmission lines in operation. This represents an addition of 266 miles of line during the fiscal year. A transmission line 17 miles long was placed in operation on the Boise project from Black Canyon Dam to the C line pumping plant during the fiscal year. This line will provide power to meet the pumping requirements to deliver water to approximately 25,000 acres of new land. A 115-kilovolt transmission line 36 miles long from Brush to Sterling and a 48-mile, 69-kilovolt extension from Sterling to Holyoke were completed on the Colorado-Big Thompson project during the fiscal year to provide a power supply for rural and municipal uses in the vicinity of Holyoke, Colo. A 115-kilovolt transmission line 78 miles long was placed in operation on the Davis Dam project from Phoenix to Eloy, Ariz., to provide additional power supply to irrigation pumping loads in the vicinity of Eloy, Ariz. A 115-kilovolt transmission line 87 miles long was placed in operation on the Rio Grande project from White Sands Proving Grounds to the town of Alamogordo and an extension to Hollywood. This line will supply power to Community Public Service Co. at Alamogordo and the Otero County REA Cooperative at Hollywood.

ELECTRIC ENERGY SALES

Electric energy sales from 16 power plants operated by the Bureau of Reclamation for fiscal year 1948 reached an all-time high of 15,256,732,000 kilowatt-hours. This compares to a total of 12,103,666,000, during fiscal year 1947. Revenues from the sale of power also reached an all-time high of $26,222,198 as compared to a total of $22,350,447 for fiscal year 1947. Major increases in sales were noted in particular on the Columbia Basin project and the Boulder Canyon project. These increases resulted primarily from increased capacity at Grand Coulee power plant and heavy demands for power in the Pacific

Northwest and increased demand in California, with favorable hydrologic conditions at Hoover Dam. Increases in sales at Parker Dam project resulted from the resale of purchased West coast energy to assist in meeting the power requirements for irrigation pumping and other uses in the State of Arizona. Other smaller increases were noted as a result of the heavy demand for power in combination with favorable hydrologic conditions. Exceptions were noted on a number of projects, primarily as a result of low-water conditions. Reduction in energy sales were noted on the Boise, Yuma, Rio Grande, North Platte, and Kendrick projects. A summary of power sales and revenues by project is shown on table 2.

TABLE 2.—*United States Department of the Interior, Bureau of Reclamation power systems, power sales and revenues by projects, fiscal year ending June 30, 1948*

Project	Sales of electric energy (kilowatt-hours)	Revenues from sales of electric energy (dollars)
Boise	29, 056, 279	44, 371
Boulder Canyon	5, 368, 677, 464	8, 771, 847
Central Valley	1, 353, 681, 641	3, 798, 278
Colorado-Big Thompson	120, 729, 542	782, 970
Columbia Basin	6, 935, 826, 000	6, 991, 992
Fort Peck	203, 899, 503	600, 376
Kendrick	101, 959, 903	539, 387
Minidoka	116, 034, 220	419, 261
North Platte	36, 900, 111	404, 345
Parker	832, 485, 790	3, 036, 900
Rio Grande	54, 763, 354	281, 772
Riverton	19, 740, 424	139, 723
Shoshone	50, 994, 516	314, 791
Yakima	22, 852, 049	59, 068
Yuma	9, 130, 797	37, 117
Total	15, 256, 731, 593	26, 222, 198

POWER CONTRACTS

During fiscal year 1948, power was delivered to numerous major and minor users of power. Major deliveries were made to 24 municipalities, seven State government agencies, 47 rural electric cooperatives, 3 Federal agencies, 42 public authorities, 45 commercial and industrial users, and 36 privately owned utilities. A summary by classifications of customers for the 12 months ending June 30, 1948, are shown on table 3.

During fiscal year 1948, 62 contracts for delivery of power were executed. These include 6 contracts with irrigation districts, 20 with privately owned utilities, 5 with other Federal bureaus and agencies, 18 rural electric cooperatives, 5 municipalities, and 8 other customers. A number of these contracts were renewals of expiring contracts or revisions resulting from changed conditions. On the Parker Dam project, 10 contracts were executed with existing customers to cover the resale of energy purchased by the project from the city of Los Angeles and the Southern California Edison Co.

The Bureau of Reclamation had previously entered into a contract with the Montana-Dakota Utilities Co. for the use of their facilities to wheel power to Bureau customers in areas where Government transmission systems were not available. Under this contract with the Montana-Dakota Utilities Co., the Bureau was enabled to execute eight contracts with electric cooperatives during fiscal year 1948.

The Bureau of Reclamation at the beginning of fiscal year 1949 had 107 power-delivery contracts under negotiation. These contracts are for power delivery to 7 irrigation districts, 17 privately owned utilities, 7 other Government agencies and bureaus, 42 cooperatives and public power districts, 22 municipalities, and 12 others. A number of these are to revise or renew existing contracts. Included in the contracts under negotiation are contracts with 11 electric cooperatives and 1 irrigation district to be served through the wheeling arrangement made with the Montana-Dakota Utilities Co. The major number of contracts under negotiation are for future power deliveries at such time as additional generating capacity now under construction is placed in operation.

TABLE 3.—*Summary by classification of customers for 12 months ending June 30, 1948*

	Number of customers	Sales of electric energy (kilowatt-hours)	Revenues from sales of electric energy (dollars)
Privately owned utilities	36	4, 160, 423, 142	9, 832, 097
Municipal utilities	24	3, 003, 532, 160	4, 738, 034
State government utilities	7	567, 132, 767	1, 914, 132
Cooperative utilities	47	58, 807, 914	472, 086
Other Federal utilities	3	6, 946, 467, 878	7, 076, 783
Residential and domestic	526	2, 868, 745	18, 485
Rural	4	75, 344	879
Commercial and industrial	45	59, 493, 706	395, 125
Public authorities	42	396, 525, 304	1, 634, 213
Interdepartmental	26	61, 300, 953	138, 632
Other sales	1	103, 680	1, 732
Total all customers	761	15, 256, 731, 593	26, 222, 198

Legislation

During the fiscal year a number of laws were enacted by the Congress which directly affected the Bureau of Reclamation.

Among these were Public Law 462 (S. 1990), which provided a means for the orderly continuation and completion of the Deer Creek and aqueduct divisions of the Provo River project, Utah, and for the recovery by the United States of the actual construction cost thereof.

Public Law 482 (S. 1306) was enacted for the purpose of removing doubt as to the legality of construction of the San Jacinto-San Vicente aqueduct.

Three laws were enacted by Congress during the recent session concerning provisions for the education of pupils who are dependents of employees of the United States at certain projects. Public Law 528 (S. 1985) provides for payment to the Boulder City School District of certain fees for instruction of pupils who are dependents of employees of the United States living in or near the vicinity of Boulder City. Similar provisions were made by Public Law 586 (H. R. 4201) to reimburse school districts serving the Fort Peck project for educational facilities furnished to pupils who are dependents of persons engaged in the construction, operation, and maintenance of the project. By Public Law 835 (H. R. 6029) provision is made for the education of dependents of persons employed on the actual construction of projects by the Bureau of Reclamation in cases where, by reason of such construction activity, an undue burden is cast upon the facilities of the public-school districts serving the project areas.

In addition to these three acts, the Interior Department Appropriation Act, 1949, Public Law 841 (H. R. 6705), contains additional provisions relating to payments to school districts for instruction of dependents of Bureau of Reclamation employees and contractors' employees while projects are actually under construction but with the restriction that a tuition charge of $25 per semester shall be charged and collected for each such dependent attending such schools.

Public Law 553 (H. R. 4966) provided for the sale and lease by the Secretary of the Interior of certain houses, apartments, and lands in Boulder City, Nev., which had been acquired from Defense Homes Corporation.

Public Law 555 (H. R. 6067) provided a basis for and authorized the execution of an amendatory repayment contract with the Northport Irrigation District.

Public Law 570 (H. R. 5901) amended section 2 (d) of the Boulder Canyon Project Adjustment Act (54 Stat. 774) to provide for the distribution among the States of Colorado, New Mexico, Utah, and Wyoming of the receipts of the Colorado River Development fund for use in the fiscal year 1949 to 1955 on a basis which is as nearly equal as practicable and to make available other funds for the investigation and construction of projects in any of the States of the Colorado River Basin in addition to appropriations for said purposes from the Colorado River Development fund.

By Public Law 580 (H. R. 3602), Congress granted consent to the States of Idaho and Wyoming to negotiate and enter into a compact for the division of the waters of the Snake River and its tributaries.

Public Law 602 (H. R. 3731) authorized modification of the repayment contracts with Lower Yellowstone Irrigation Districts No. 1 and No. 2 in recognition of land reclassification made pursuant to section 8 of the Reclamation Project Act of 1939 (53 Stat. 1187).

The construction, operation, and maintenance of the Kennewick division of the Yakima project, Washington, was authorized by Public Law 629 (H. R. 4954) and of the Preston Bench project, Idaho, by Public Law 644 (S. 1987).

In order to assure continuous operation of irrigation or power systems operated by the Bureau of Reclamation, Public Law 790 (H. R. 3218) was enacted authorizing an emergency fund to be made available for this purpose.

In addition to public laws set forth above, a number of private laws were enacted for various purposes.

Several measures introduced in Congress but which failed of passage are discussed briefly because of their importance, inasmuch as they would have made basic changes in the Reclamation Laws.

H. R. 2873, known as the Rockwell Bill, in the form in which it was reported out by the Committee on Public Lands of the House, with the approval of the Department, would have provided for certain revisions in section 9 (a) and 9 (c), respectively, of the Reclamation Project Act of 1939. The revisions in section 9 (a) would have authorized the allocation of costs of proposed projects to certain additional purposes to which the allocation of costs on a nonreimbursable basis is not now provided for by law. Those additional purposes are salinity control, silt control, and recreation. It would, furthermore, have authorized the reexamination of existing projects and the allocation to the extent justified of costs of such projects to fish and wildlife conservation, salinity control, silt control, recreation, flood control, and navigation.

The amendments to section 9 (c) consisted in the main of providing for the return of capital investment in the power features within 78 years from the time the power features became revenue producing or within the useful life of power features, whichever would be shorter; for the return of interest on the unamortized annual balance thereof at the rate of 2½ percent per annum; for the application of one-fifth of the revenues derived from the interest component of power rates in aid of irrigation; and for the return of the irrigation subsidy from power revenue within a reasonable period conforming as far as practicable to the period within which the water users would be required to repay their share of the irrigation costs.

Subsequent amendments which were contained in the bill as passed by the House of Representatives had the effect of (*a*) eliminating the Secretary's present authority to authorize projects or additions to projects upon the making of appropriate findings; (*b*) requiring the return of power investment within 50 years rather than 78 years; and (*c*) requiring the return from power revenues of the irrigation subsidy within 50 years from the time power revenues began rather than in a period conforming insofar as practicable with the period over which the water users are required to return their share of the irrigation costs. The Senate Committee on Interior and Insular Affairs to which the bill was referred in the Senate held no hearings and made no report.

Another important bill was H. R. 3194, which would have amended section 9 (e) of the Reclamation Project Act of 1939. In its final version this bill, if it had become law, would have made contracts entered into under the provisions of section 9 (e) renewable at the option of the water users with a proviso that the contract relationship could not extend beyond 50 years in all. It would also have provided that upon the termination of the contract the water users could enter into a further agreement pursuant to section 9 (d) of the same act.

Other important bills that failed of passage are:

(1) S. J. Res. 145—The McCarran resolution to direct the Attorney General to institute an action in the Supreme Court to settle the Lower Colorado River controversy.

(2) S. 299—To extend the reclamation laws to Arkansas; H. R. 2440—To extend the reclamation laws to Louisiana; H. R. 2180—To extend the reclamation laws to Alaska, Puerto Rico, Hawaii, and Guam.

LITIGATION

The Bureau has been concerned with extensive litigation of varied types during the fiscal year. A number of suits have been filed naming the Secretary or the United States as defendant as a result of the construction of Friant Dam, Central Valley project, California. In the case of *Rank* v. *Krug*, and related cases, the legality of the operation of Friant Dam has been challenged. The cases are of particular significance, inasmuch as the plaintiffs have in effect challenged the constitutionality of the authorization of the Central Valley project. In addition, some fifty suits involving water rights in the Central Valley project are pending in varying stages in the Court of Claims, the United States District Court for the Southern District of California, and the District Court for the District of Columbia.

Other litigation pending includes an adjudication proceeding in the District Court of Colorado at Breckenridge which, if pursued to final decree, would ultimately determine the respective rights as between the Government and the City and County of Denver in the flow of the Blue River. This proceeding concerns the Colorado-Big Thompson project.

A total of 193 actions were instituted in the United States District Court for the District of Oregon under the Federal Tort Claims Act arising out of a break which occurred in the North Canal of the Owyhee project in 1946. Of these cases, 191 seek damages for loss of crops and two seek damages for losses caused by the flooding of land.

The Congress authorized the institution by construction contractors of proceedings in the United States District Court in two cases (Private Law 441 and Private Law 456) arising out of contractor's claims resulting from the Government's failure to furnish steel in connection with certain construction contracts. By Private Law 457 Congress also conferred jurisdiction on the Court of Claims to rehear a case in which the contractor had failed to exhaust his administrative remedy under the contract provisions.

Another case pending is that of *Warner Construction Co.* v. *Krug et al.*, instituted pursuant to Public Law 657, Seventy-ninth Congress, which is a claim for increased costs alleged to have been incurred due to war conditions in connection with a contract for the construction of Green Mountain Dam, Colorado-Big Thompson project.

In the case of *Northern Pacific Railway Co.* v. *U. S.*, involving freight charges for shipments of cement to the Columbia Basin project, both parties have appealed a decision rendered by the United States District Court in St. Paul.

A complaint is also pending before the Public Utilities Commission of California wherein the Government is seeking reparations from the Southern Pacific Railroad Co. for allegedly excessive charges for transportation of cement used in the construction of Shasta Dam, Central Valley project.

A considerable amount of legal work was required in connection with the numerous claims of all types filed under the provisions of the Federal Tort Claims Act.

Of two suits (*California Zinc Co. et al.* v. *U. S.* and *U. S.* v. *Shasta Iron Co.*) involving claims resulting from the impounding of water in the Shasta Reservoir, Central Valley project, the Shasta Iron Co. case was disposed of by an entry of judgment in condemnation and a proposed basis for settlement of the California Zinc Co. case was under consideration at the close of the fiscal year.

International boundary and water treaties.—Interagency arrangements were formulated for performance of engineering design and related work by the Bureau of Reclamation for the International Boundary and Water Commission, United States and Mexico, in connection with international storage dams on the Rio Grande under the Mexican Water Treaty of 1944 and with the United States section of the Commission concerning certain treaty works on the Colorado. Extensive legal study progressed in the fiscal year and discussions were had among representatives of the Departments of the Interior, State, Justice, the United States section of the Commission and the Imperial Irrigation District of California concerning the effect of the treaty on the All-American Canal contracts.

There were initiated two references to the International Joint Commission, United States and Canada, under the Boundary Water Treaty of 1909 with Great Britain, contemplating investigations and advisory reports involving certain defined drainage basins of interest to the United States and Canada. The results of these references will be of significance to the Missouri River Basin program.

General.—Legal work in the Office of the Chief Counsel continued heavy throughout the fiscal year encompassing, in addition to the fields of legislation and litigation, construction contracts, repayment contracts, amendatory repayment contracts, power contracts, claims and the rendition of legal opinions, advice and assistance on widely diversified problems arising in connection with expanding Bureau activities.

Many legal problems relating to construction contracts were presented due to exhaustion of funds on certain projects during the fiscal year 1948. Much of the controversy perhaps stemmed from the absence of a clear-cut delineation of the respective rights and obligations of the parties under "contingent on appropriations" contracts. New forms of contractual provisions have been adopted which, it is hoped, will obviate such controversies in the future.

Supply

PROCUREMENT ACTIVITIES

During the early part of the year the Bureau's Procurement Handbook was promulgated to all field offices. This provided detailed instructions so that field offices could handle the large volume of procurement work that has been delegated to such offices for handling. Considerable progress was made during the year in the carrying out of the over-all policy of decentralizing procurement activities to the level nearest the construction site to which such work can be delegated and handled efficiently and economically.

As new projects are started, special negotiations are entered into with transportation companies with the result that the most economical transportation rates are procured for the shipment of all materials to the construction site. Hundreds of thousands of dollars have been saved during the year because of the negotiating of special rates for the movement of supplies and equipment required in connection with the Bureau's construction program. It is estimated that many thousands of dollars will be saved on shipments to the Hungry Horse project during the next few years when construction acivities will be carried on at an accelerated rate.

The distribution of standard and Bureau forms was transferred from the Secretary's office in Washington to the Supply Services Division in Denver. This has expedited the supplying of forms to the Bureau field offices, reducing materially the paper work in the

Washington office, and resulting in an over-all increase in the efficiency of handling this particular problem.

PROPERTY MANAGEMENT ACTIVITIES

The Property Management Handbook was prepared and promulgated and an active preventive maintenance and utilization program established. As a result of this program, the cost of maintaining Bureau vehicles has been materially reduced and the utilization of such vehicles has been substantially improved.

Procedures for the disposal of surplus property have been streamlined and authority to handle these matters delegated to field offices so that in the majority of cases final action can be taken without any reference to the Washington office.

A new system of registration of motor vehicles was developed and installed and a master list of all the vehicles owned by the Bureau is now available in the Supply Services Division in Denver.

OFFICE SERVICES ACTIVITIES

Revised regulations regarding the issuance of travel authorizations were prepared and distributed to all field offices.

The penalty mail restriction which was included in the 1948 appropriation bill required the use, during the fiscal year, of many innovations in the handling of official communications of the Bureau. Facts collected because of this restriction were such that Congress was prevailed upon to remove the limitation from the 1949 appropriation act.

AIRPLANES

The Bureau acquired four additional aircraft during the fiscal year, one twin-engine 10-place Lockheed Lodestar and three Fairchild 4-place single-engine aircraft. The Bureau aircraft were used for transporting personnel to projects that are difficult to reach by local means of transportation, for making preliminary location surveys for transmission lines, for the review and check of reservoir and river conditions, for the patrol of power lines, and for the photographing and preliminary checking of possible dam sites. For the most part, the cost of transportation by Bureau aircraft has been less than the cost of transportation by other available commercial means.

A plan for group aviation insurance coverage, which is available to all employees of the Bureau and all employees of the Department, was worked out with the Aviation Underwriters, Inc. This group insurance plan provides insurance at the rate of $2.70 per thousand dollars and provides coverage while flying in any Department aircraft except those that are operated in exceptionally hazardous types of operation.

MOVE TO DENVER FEDERAL CENTER

During the year the offices of the Commissioner located in Denver were moved from Federal and rented quarters in downtown Denver to the Denver Federal Center, which is located in the outskirts of the city of Denver. The Bureau spent approximately $1,000,000 in reconditioning the buildings of the old arms plant for office use. It is estimated that an excess of this amount will be saved in rentals over the next 5 years.

One entire building at the Denver Federal Center is now devoted to the Bureau's laboratory activities, now able to make tests that were not possible with the very limited laboratory facilities that were available prior to the conversion of one of the large munitions buildings in the old Denver arms plant for laboratory purposes.

Regional Reports

REGION 1

Record-breaking production in power and crops and accelerated progress in construction and project planning featured the year's activity in region I.

Farmers brought their gross crop values and per-acre values to new highs. Five Bureau power plants exceeded their greatest previous outputs in meeting record electrical system loads. The greatest construction program in history was under way, with the highlight on the million-acre Columbia Basin development. More project planning reports were completed than ever before.

Operation and maintenance.—The 15 projects in the region produced $225,235,236 worth of crops in 1947 on a cultivated area of 1,874,118 acres, consisting of lands receiving both a full and supplemental water supply. The average per-acre return was $120.18, as compared with the 1946 record high of $114.35.

The production constituted a major contribution to critical world food shortages. Among the large quantities of important crops grown were: 38,043,685 bushels of potatoes, 2,334,068 bushels of onions, 959,843,991 pounds of fruit, 2,559,662 tons of sugar beets, 19,039,783 bushels of grain, and 2,074,584 tons of hay and forage crops for beef and cattle herds.

Irrigated acreages were extended on five projects through Bureau construction. On May 15, 1948, water was delivered to the 5,500-acre Pasco unit of the Columbia Basin project. The initial delivery of water to the pump unit of the Payette Division was celebrated on June 23, 1948. Other small increases were on the Black Canyon Irrigation District (second unit) of the Boise project, north unit of Deschutes project, Roza Division of the Yakima project, and Hunt unit of the Minidoka project.

No new land was opened to homesteading during the year but the public announcement of the sale of the first 10 full-time farm units on the Pasco unit was approved in June, to be issued July 20, 1948. The Bureau had a waiting list of 2,000 for these units.

Farm unit lay-outs have been completed for more than 150,000 acres of the Columbia Basin project. A second development farm, situated on the Pasco unit, was opened, and a third, in the northerly part of the project, was being prepared for its first crops. This farm will be the scene of far-reaching tests in sprinkler irrigation.

Negotiations for new, amendatory, supplemental, or interim repayment contracts were under way with 24 irrigation districts. Agreement on basic principles and terms to be incorporated in amendatory contracts was reached with district boards of the Bitteroot, Okanogan, Kittitas, and Westland Districts. A supplemental contract with the Prosser Irrigation District, providing for a partial deferment of construction charges to permit emergency rehabilitation of the irrigation system, was signed by district officials and forwarded to Washington. A new contract with the Lewiston Orchards District was executed in September 1947.

Power production.—With the Grand Coulee power plant setting the pace, the output of five Bureau projects was at a record high of 7,138,756.262 kilowatt-hours. Gross revenues also ascended to a peak level—$7,507,260.

Grand Coulee, with an installed capacity of 992,000 kilowatts at the close of the fiscal year, carried a peak load of 1,118,000 kilowatts in May and produced a total of 6,935,826,000 kilowatt-hours during the year. Its gross revenues were $6,991,991. A daily record of 23,352,000 kilowatt-hours was set on February 13, 1948, and a monthly record of 661,634,000 kilowatt-hours was reached in May.

The 13,500-kilowatt Minidoka power plant produced 111,118,750 kilowatt-hours to earn gross revenues of $378,025.82. The Boise project, with the 8,000-kilowatt Black Canyon and 1,500-kilowatt Boise River plants, produced 67,536,256 kilowatt-hours to earn $97,970.27 in gross revenues. The 2,400-kilowatt Prosser power plant on the Yakima project produced 24,275,256 kilowatt-hours and earned $59,272.69 in gross revenues.

Construction.—Keeping abreast with the most ambitious building program ever outlined for a single reclamation project, the Columbia Basin project had a total of 40 million dollars in major construction and equipment contracts under way during the year as it aimed for a goal of having a huge block of new farms under irrigation by 1952.

By the end of the fiscal year, work was well advanced on three large earth-and-rock dams, several siphons, a large tunnel, and other structures. Completion percentages moved steadily upward following a late summer slow-down caused by fund shortages. Private contractors reached the following marks: northerly section of main canal, 88 percent complete; Bacon tunnel and siphon, 48; Long Lake Dam, 63; first section of West Canal, 73; first section of East Low Canal, 35; Pasco pumping plant, 99.8; Pasco laterals, complete; O'Sullivan Dam, 75; and South Dam, 88.

Construction was initiated late in the fiscal year on Hungry Horse Dam in northwestern Montana, which will be the fifth highest and fourth largest concrete dam in the world. The scheduled completion date is fiscal year 1954 with the initial development of power set for June 1952.

On the Boise project, the embankments for Cascade and Anderson Ranch Dams were completed. Remaining work on Cascade is scheduled to end in fiscal year 1950. Anderson Ranch Dam is to provide full storage of 493,000 acre-feet by the end of the next fiscal year and full power development in April 1950. The cost-plus-fixed-fee contract at Anderson Ranch was ended in March 1948, and a new contract awarded to complete the dam, spillway, and outlet works and to construct the power plant.

Construction of the 65-mile long main canal on the Deschutes project was completed and laterals were built to serve 41,500 acres of new land. Construction is in progress on the remaining laterals to serve an additional 8,500 acres. A contract was awarded for the completion of Wickiup Dam and the rehabilitation of a portion of the main canal flume of the Arnold Irrigation District. While all major construction is scheduled for completion during fiscal year 1949, work to reduce water losses in Wickiup Reservoir, the river channel, and canal and lateral systems, will be carried on through fiscal year 1952.

On the 27,000-acre pumping unit of the Roza division of the Yakima project, laterals were constructed for 14,500 acres. Delays in receiving equipment for the pumping plant and in negotiations for a supplemental or interim contract retarded progress.

Construction of Lewiston Orchards project was started in September 1947. In the Hunt area of the Gooding division of the Minidoka project, laterals to serve the final 4,500 acres of the 8,000-acre public land development were completed. Construction was 50 percent complete on the Locket Gulch Wasteway of the North Canal on the Owyhee project. Preconstruction work on the Palisades Dam was practically completed.

Project investigations.—With greater emphasis being placed on completion of project investigation reports in fiscal year 1948, half again as many project investigations were completed this year as in the preceding year. Of 31 projects under study, one report on plans for basin development and five project reports were sent to the Commissioner. Twenty-eight project investigations were continued from the program of the preceding year and only three new project investigations, for which there was urgent need, were initiated.

The Kennewick (Yakima project) and Hells Canyon reports were completed. Other project planning reports completed included The Dalles project, West unit, Oregon; Canby project, Oregon; and the Cambridge Bench project, Idaho.

The report on alternative plans for Rogue River development was completed to provide a basis for expression of public opinion at a hearing held in Medford, Oreg., on June 8 and 9, 1948, to determine wishes of people in the Rogue River Basin.

The Columbia River Basin report was presented to the President and was released in printed form for review prior to submission to Congress.

REGION 2

The schedule for fiscal year 1948 detailed a continuing construction plan for the Friant-Kern, Delta-Mendota, and Contra Costa canal systems, Shasta Dam and power plant, Keswick Dam and power plant, Friant Dam, transmission lines, and miscellaneous elements of the project, requiring an estimated over-all expenditure of $40,000,000. On June 30, 1948, the year's construction investment in these features amounted to $39,000,000.

Placing a Shasta generating unit in service during the year helped in part to relieve the power shortage caused by drought.

Project planning.—The highlight of the planning program for the year was the preparation of the final report and authorization of the Cachuma unit, Santa Barbara project, California, March 24, 1948.

The Solano project report was completed and transmitted to the Governor of California and the affected Federal agencies before the close of the fiscal year. A preliminary report on the American River Development was submitted to the Public Lands Committee of the House of Representatives. Reports on the North Fork Kings River development, the Upper Sacramento River tributary plan, and Clikapudi project were nearing completion.

Construction.—The storage capacity of Millerton Lake was increased approximately 84,000 acre-feet by installing spillway drum gates at Friant Dam. The contract for the outlet structure, stilling basin, landscaping and parking area improvements was completed.

Unprecedented construction progress on the Friant-Kern canal resulted in the completion of 26.9 miles of canal and virtual completion of 9.8 miles. Although contractors were restricted due to shortage of funds, work on an additional 36.8 miles of the canal was more than half completed. The award of a new contract for 14.3 miles of canal and two major siphon structures advanced construction to the vicinity of Lindsay, making a total of 88 miles completed or under contract.

Delta-Mendota canal construction continued under two contracts. The award of a third contract for 13.1 miles of canal brought 36.2 miles under active construction. The intake canal was approximately two-thirds completed and piling was driven for the pumping plant foundation.

Construction of the Contra Costa, Clayton, and Ygnacio canals and pumping plants was nearing completion.

The installation of one additional 75,000-kilowatt generator at Shasta Dam was completed, a second was nearly finished, and work started on the final unit.

A contract was awarded for construction of two 230-kilovolt West Side transmission lines from Shasta to a point west of Shasta substation. To dispose of additional power available at Shasta power plant, a temporary wood pole tie line was constructed to the substation.

Construction continued on Keswick Dam and power plant, Keswick switchyard and Keswick tap lines.

Power.—Throughout the year, the area power shortage was the most critical in the State's history. A 20 percent curtailment in power use was enforced by the California State Public Utility Commission.

Generated during the fiscal year were 1,380,106,000 kilowatt-hours, yielding a gross revenue of $3,785,066.99, a slight increase over the previous year. Despite the most serious winter drought in the area's history, the kilowatt hours delivered exceeded contract commitments by over 68 percent and a power demand exceeding contract commitments by an average of 9 percent was met for the first 8 months of the year. The existing contract with the Pacific Gas and Electric Co. was amended to provide contract rates for the overload capacity of the first two generators at Shasta power plant, and on a day-to-day basis, for the capacity of the third generator which was placed in service in March.

The Pacific Gas and Electric Co. continued to decline to furnish electricity on a conveyance or exchange basis to the Federal Government, State, or the Bureau's preference users. As a result, the Government instituted formal proceedings before the California State Public Utilities Commission with a view to establish a rate and rules and regulations for this type of utility service.

The city of Los Angeles applied for electricity, and organized irrigation districts manifested increased interest in a Bureau power supply. In May 1948, the Shasta Dam area P. U. D., became the first public agency to receive Shasta power.

Operation and maintenance.—Operating the Central Valley project during fiscal year 1948 involved the handling of 6,469,162 acre-feet of water at Shasta and Friant Dams and in the Contra Costa canal system. About 3,643,000 acre-feet of this amount was released through the Shasta power plant. Land receiving water from storage amounted to 770,000 acres with 250,000 acres served in the Sacramento Valley and 520,000 acres in the San Joaquin Valley. The remaining multiple-purposes of navigation, salinity control, flood control, aid to salmon propagation, and municipal and industrial water requirements were adequately served.

The land opening of 3,522 irrigable acres on the Klamath project drew a record 23,000 inquiries from veterans interested in acquiring a farm home. Of these, 4,023 filed applications for the 44 farm units available. The local examining board declared 2,758 of the applicants eligible to participate in the drawing which was held on March 14, 1948. One woman and forty-three men were selected to receive farm units.

Because of new information and changed agricultural conditions, revised studies were made of the allocation of water from the Friant-Kern canal to be supplied to present and potential irrigation districts. Contract negotiations for water service and in some cases for distribution systems were completed or carried to various stages of completion with the Lindsay-Strathmore, Madera, Lindmore, Orange-Cove, and Shasta View irrigation districts, with the Southern San Joaquin Municipal Utility District, the Summit City Public Utility District, and the Contra Costa County Water District. Payment capacity studies were made for the areas embraced by several of these and similar agencies throughout region II.

REGION 3

The year was highlighted by seven major steps in resources development: (1) Completion of Coachella canal; (2) diversion of Colorado River at Davis Dam; (3) completion of initial phases of Davis Dam project transmission work; (4) settlement of 80 war veterans on Yuma and Gila projects; (5) completion of San Diego Aqueduct; (6) beginning of construction of Colorado River dredge; and (7) completion of Central Arizona project report.

Meanwhile, the Hoover, Parker, and Siphon Drop power plants generated a near record of over 6 billion kilowatt-hours. This was 23 percent higher than in the previous year and nearly 43 percent of the region's power requirements. Farms irrigated by Reclamation facilities produced a 1947 income of 134⅔ million dollars, slightly less than in 1946, from 806,332 acres.

The Coachella Branch of the All-American canal was completed on June 26, 1948. Some 2,000 acres of water-short land were irrigated from the canal during the 1947–48 season. The Coachella Valley

County Water District approved a contract covering repayment of 13.5 million dollars for a distribution system to serve 75,000 acres.

The Colorado River was moved into its new channel at Davis Dam on June 28, 1948, by closure of the upstream cofferdam. Following construction of a downstream cofferdam, unwatering of the foundation area and excavation for the dam embankment was started.

Substantial progress was made in surveys, plans, designs, procurement of supplies and materials, and construction of Davis Dam project transmission lines and substations. Construction power facilities, the Second Parker-Phoenix 161-kilovolt line, the Parker-Gene 230-kilovolt line, and the Phoenix-E. D. No. 5 section of the Second Phoenix-Tucson 115-kilovolt line were completed and in operation. Temporary facilities in the Parker 230–161–kilovolt switchyard were replaced by a permanent 90,000-kilovolt-ampere transformer bank and associated equipment. Construction contracts were awarded for the Davis-Parker 230-kilovolt line, the Second Parker-Gila line, and the Second Gila-Yuma 34.5-kilovolt line.

Drawings for 26 homesteads on the valley and reservation divisions of the Yuma project and 54 units on the Yuma-Mesa division of the Gila project were held March 10, 1948 and June 29, 1948, respectively. There were 1,637 applications, or 20 potential farmers to every available farm.

First water flowed through the San Diego aqueduct at 2 a. m. November 26, 1947. Actual construction by the Navy, in accordance with Bureau surveys, designs, and specifications was begun September 12, 1945. Completion was in time to avert serious consequences of a prolonged shortage in the San Diego water supply.

River control operations were concentrated on relief and permanent protection of Needles, Calif. The 20-inch hydraulic suction dredge for use in cutting a new river channel at Needles was designed under contract and its construction was 50 percent completed. The dredge is expected to be placed in operation early in 1949.

The Central Arizona project report was completed in December 1947 and transmitted by the Department to the President. The report presents a plan to supply supplemental water from the Colorado River to irrigated lands in the Salt River and Gila River Valleys, comprising about 600,000 acres. Unfavorable reports on the Chino Valley, Snowflake, and Hassayampa projects in Arizona were completed.

Other regional highlights included the completion of All-American canal connections for the Bard district and the reservation division of the Yuma project, making it possible to discontinue Laguna Dam diversions on the California side. Basis was laid for a revised contract with the North Gila Valley Irrigation District which would terminate deliveries at Laguna Dam on the Arizona side and provide service from the Gila gravity canal. Rehabilitation surveys for the Salt River and Yuma projects were substantially completed. A large part of the preliminary site surveys and diamond-drilling of two alternate sites for Glen Canyon Dam on the Colorado River above Lee Ferry, Ariz., was completed. Maintenance work on the temporary rock diversion weir for the Palo Verde Irrigation District was continued. Although the amounts to be released were predicated on downstream irrigation requirements, all water passed at Hoover and Parker Dams was utilized for power production.

The Arizona Power Authority, acting for the State of Arizona, made formal request for two full-size generating units, or the equivalent, and related equipment to permit delivery of the State's allocation of Hoover energy.

REGION 4

Region 4, situated literally in the heart of the arid west, embraces most of Utah and Nevada, Western Colorado, Southwestern Wyoming and parts of Idaho, New Mexico, and Arizona. This area comprises three major drainage basins—the Upper Colorado River Basin, the Bonneville Basin, and the Lahontan.

Federal reclamation in this territory ended the fiscal year 1948 on June 30 with several accomplishments of greater than usual significance. Two developments are of major importance because it is anticipated they will lead ultimately to authorization of numerous worth-while, although presently unattractive, irrigation projects with incidental production of great quantities of hydroelectric energy for which a market already exists in the Bonneville Basin.

Throughout the year the region provided extensive factual information to the Upper Colorado River Basin Compact Commission and its important engineering committee and agreement was reached in July 1948 on a compact for division of water among the States of the Upper Basin—Colorado, Utah, Wyoming, New Mexico, and Arizona. In the event the legislatures of these States and the Congress ratify a compact, thus giving it legal status, the prerequisite to construction of new projects in the Upper Basin will have been consummated.

Anticipating the likelihood of an Upper Basin Compact, the region late in the fiscal year reprogrammed its work on the main stem of the Colorado River to consider as a possibility the future pooling of hold-over storage and power benefits under the Colorado River storage project. This project consists of the principal potential multipurpose dams as units benefiting the entire Upper Basin. The announced purpose of the Colorado River storage project investigation is to determine the most economical, feasible, and desirable combination of dams, reservoirs, and power installations that will provide necessary river regulation; long-time hold-over storage; maximum yield of irrigation water; silt and flood control; recreation; and hydroelectric power to aid in repayment of irrigation projects otherwise infeasible as well as to aid in development of mineral and other natural resources. Tentatively selected as the units to be recommended for first construction were the Glen Canyon unit on the Colorado River in Arizona, the Echo Park unit on the Green River in Colorado and the Bridgeport Dam near Grant Junction on the Gunnison River. The drilling of Glen Canyon and Bridgeport Dam sites and completion of a power market survey for the Bonneville Basin and related areas definitely contributed during the fiscal year to advancement of the Upper Colorado River Basin program.

The region achieved an all-time high as the Bureau's second-ranking crop producer. The 16 operating projects produced $48,017,000 in gross crop values from 540,151 acres—a gain of nearly $9,000,000 over 1947 due to increased returns per acre and a cultivated acreage jump of 12,381.

Construction continued on a modest scale, with a program approaching $4,000,000. This differed from the scheduled program only in minor respects due to delays caused by contractors' inability to secure vital material. Three major features of the Provo River project, Utah—the Duchesne Tunnel, the Provo Canyon and Big Cottonwood sections of the Salt Lake Aqueduct—were advertised near the end of the year. When finished, these will complete the war-delayed Deer Creek and aqueduct divisions of Utah's largest reclamation project. Exceptional progress made on the Jackson Gulch Dam inlet and outlet canals indicated completion of the Mancos project, Colorado, early in fiscal year 1949, approximately 2 years ahead of schedule. Specifications were issued for construction of Spring Creek Dam, Paonia project, Colorado, and spillways completing the Newton Dam, Newton project, Utah. An immediate start was made on the Preston Bench project, Idaho, under a schedule calling for issuance of specifications for all construction by September 15, 1948, although the project was not authorized nor funds appropriated for construction until June 25, 1948.

Revision of the Lahontan Basin Report was completed during the fiscal year and final reports were prepared on the Emery County and Jensen projects in Utah, the Lyman project in Wyoming, and the Preston Bench project in Idaho. Preliminary reports were completed on the Silt and Minnesota projects in Colorado. A status report was issued on the Weber Basin project in Utah.

Principal provisions of an amendatory repayment contract with the Uncompahgre Valley Water Users Association that will supersede 10 existing contracts for repayment of Uncompahgre project, Colorado, construction costs were agreed upon and after final approval will be submitted to the Eighty-first Congress.

A contract was signed with the Mancos Water Conservancy District providing for increase of construction contract obligation from $600,000 to $900,000 with a 20-year extension of the original 40-year repayment period.

REGION 5

About 211,500 acres in 7,152 farms supporting a population of 42,031 were irrigated in 1947. Total gross crop income was $49,084,827.

Final drafts of report on the Canton project, Oklahoma; the Middle Rio Grande project, New Mexico, and a preliminary draft of a report on the Vermejo project, New Mexico, were prepared and forwarded to the Commissioner's Office. A reconnaissance report on the Green's Bayou area of Harris County, Tex., was completed.

In the fiscal year 1948, 39 miles of 115,000-volt electric lines were completed and put in operation from Alamogordo to Hollywood, N. Mex. Seventy-two miles of 115,000-volt line from Elephant Butte to Socorro, N. Mex., were completed except for a conductor. A report was prepared and approved by the Secretary for construction of the Velarde steam and electric plant and the Albuquerque-Santa Fe-Los Alamos-Velarde 115,000-volt transmission lines.

Four projects were under construction in fiscal year 1948. These were W. C. Austin project, Altus, Okla.; Rio Grande project—power and storage division, New Mexico; Tucumcari project, New Mexico; Marshall Ford Dam—Colorado River project, Texas. Work was completed on Marshall Ford Dam. Construction continued on the remaining three projects.

Hudspeth project, Texas.—Irrigation water was delivered to the Hudspeth project in accordance with the Warren Act contract dated 1924 with the Hudspeth County Conservation and Reclamation District No. 1. This project has an irrigable area of 18,326 acres. During the crop year 1947, 17,172 acres were irrigated and produced crops valued at $3,994,089 a total of $232.59 per cropped acre.

Carlsbad project, New Mexico.—In 1947, the 21,545 acres irrigated produced a total crop value of $2,326,536, or $107.98 per cropped acre.

W. C. Austin project, Oklahoma.—For the crop year 1947, facilities were completed to serve an area of approximately 9,600 of the project's 49,972 acres but only 3,273 acres were irrigated. Crop production from 3,273 acres amounted to $344,788, or $105.34 per cropped acre. On June 30, 1948, approximately 8,843 acres were receiving irrigation water, and facilities were completed to serve 31,800.

Tucumcari project, New Mexico.—Of 44,711 irrigable acres facilities were completed to serve 8,871 acres, but only 4,563 acres were irrigated for the full crop season and produced crops valued at $244,637, or $53.61 per cropped acre. On June 30, 1948, facilities had been completed to serve approximately 25,000 acres, of which approximately 11,356 acres had been irrigated.

Balmorhea project, Texas.—Under provisions of the Water Conservation and Utilization Act, the Bureau acquired Phantom Lake Spring and constructed necessary canal facilities for making the spring water available to the Balmorhea project. First water became available to the project about July 1, 1947, so that its full effect on the crop production is as yet unknown. There are approximately 10,652 acres in the Reeves County Water Improvement District No. 1, of which 7,126 acres were irrigated during the crop season of 1947. This area produced crops valued at $773,170, or $108.50 per cropped acre.

CONSTRUCTION

On the W. C. Austin project, Altus, Okla., the dam is complete except for the installation of radial gates on the controlled spillway and operating bridge across the dam. The contract for the installation of the gates has been awarded and should be completed by March 1949. The Main, the Altus, and the West canals are complete and irrigation of a portion of the land is under way. This project was 84.5 percent complete as of June 30, 1948.

Construction work continued on the Rio Grande project storage and power division. Rio Grande power transmission facilities to Hollywood, N. Mex., on the east were placed in operation. Alterations of the Elephant Butte Dam spillway were completed.

On the Marshall Ford Dam of the Colorado River project of Texas delivery and installation of a gantry crane, a stand-by generating unit, and parapet lights completed all work and the project is 100 percent complete.

On the Tucumcari project approximately 59 miles of the Conchas canal and 17 miles of the Hudson canal were completed to furnish irrigation water to approximately 25,000 acres of irrigable lands in the first five units. This project was 75.9 percent complete as of June 30, 1948.

The Balmorhea (modified) project is now complete and only minor repairs for the protection of the Madera diversion dam and the Phantom Lake canal siphon and construction of wiers were carried out by the project and district forces during this last fiscal year.

POWER FACILITIES

The hydro generating plant at the toe of Elephant Butte Dam, consisting of three 8,100-kilowatt generating units and the transmission system, constitute the existing power facilities in region 5. The estimated annual salable output of the plant is 91,000,000 kilowatt-hours. Total energy sold in the fiscal year 1948 was 54,763,354 kilowatt-hours, which produced a revenue of $281,774.57. Generation was below normal due to low water conditions in Elephant Butte Reservoir.

A 72-mile 115-kilovolt transmission line is under construction from Elephant Butte to Socorro, N. Mex., for power delivery to the Socorro Electric Cooperative.

Planning developments.—Preliminary draft of departmental report was completed on the Vermejo project. Final drafts of departmental reports were completed on Canton and Middle Rio Grande projects, the latter report being forwarded to the Congress during the fiscal year. A reconnaissance report was completed on the Harris County project involving the Greens Bayou area.

REGION 6

The 1948 program of the region called for an expansion of all activities related to conservation, control, and utilization of Missouri River Basin water resources. Specific objectives included initiation of construction on 8 units of the Missouri River Basin project; orderly continuation of construction on 9 units or projects; an accelerated program of preconstruction and planning affecting 25 units or subbasins; and operation and maintenance of 11 operating projects. Crops valued at $21,923,000 were produced during 1947 on operating projects in the region, exceeding by $3,220,000 the 1946 record crop. The three hydro power plants in operation generated 294 million kilowatt-hours of energy, resulting in revenues of approximately $1,100,000.

Investigation.—Investigations in the four major subbasins in the region included aerial topographic surveys in the Powder, Tongue, Clarks Fork, Upper Missouri, Missouri-Souris, and Oahe areas; more detailed topographic surveys by ground forces for many dam and reservoir sites; land classification; dam-site exploration; preliminary economic studies; and other work necessary for preparation of basin plans and reports. Suitable arrangements were made, or continued in effect, to insure that cooperating State and Federal agencies presented plans for the phases of development covered by their respective interests.

Preconstruction work carried forward on 17 units in the region included detailed surveys and exploration of dam sites; detailed surveys and classification of irrigable land; materials investigations; detailed economic studies; farm unit lay-outs; preliminary design work and other activities necessary to ready the units for construction. Here, again, cooperating agencies contributed to and actively participated in the studies. Where the magnitude of a unit did not permit detailed study of the entire area, block areas were established; and detailed studies made in those block areas were used as a basis for estimates for the entire unit. Development farms were established and operated in Montana, North Dakota, and South Dakota to provide a basis for designing units in their respective areas, and to demonstrate the desirability of irrigation in those areas.

Construction.—Angostura unit: Sixty-two percent of the dam contract was completed by the end of the fiscal year. A contract for clearing part of the reservoir site was awarded in June 1948. Belle Fourche unit: A contract was awarded in June for furnishing and erecting 10 prefabricated residences for the Keyhole Government camp. Preconstruction activities on the dam were started. Boysen unit: Construction of the Boysen Dam, power plant, and relocation of the C. B. & Q. Railroad began September 30, 1947, under a $13,900,000 contract, and was ahead of schedule at the end of the year.

Buffalo Rapids project—second division: The contract for the construction of the Fallon pumping plant, relift plant, canals and laterals was completed during the fiscal year. Canyon Ferry unit: Six construction contracts were awarded for relocation of county roads (85 percent complete) and Government camp facilities (40 percent complete). Designs and specifications for the dam were nearly completed. Fort Peck project: About 11 percent of the contract for the Glendive-Miles City and Fort Peck-Williston 115-kilovolt transmission lines was completed. Construction of the McCone County Electric Cooperative (Circle) substation began in May. Specifications for the construction of a 7,500-kilovolt-ampere substation at Wolf Point, Mont., and a 2,000-kilovolt-ampere substation at Savage, Mont., were prepared and issued. Equipment contracts were executed for the Williston substation. Grand River unit: Contracts were awarded for the Government camp and for construction of the access road for Shadehill Dam. Designs and specifications for the dam were well advanced. Heart River unit: Construction of the Heart Butte Dam and dike, a $2,360,743 contract, began in March. Specifications for the construction of Dickinson Dam were ready for issuance. Moreau River unit: A contract was awarded for Bixby Dam Government camp. Preconstruction work on the dam was advanced to permit contract award in 1949.

Powder River unit: A contract was awarded for the Government camp at Moorhead Dam and work on design data for the dam was well advanced. Riverton project: Construction continued on the Lost Wells lateral system and a portion of the Wyoming canal system. A contract was awarded in April for construction of the second section of the Wyoming canal, Sheep Camp drain, and the North Pavillion lateral system. Specifications covering construction for a third section of the Wyoming canal and a portion of the Muddy Ridge canal and distribution system were issued in June. Shoshone project: Construction of the Heart Mountain canal continued. Alkali Creek drain, lateral extensions, and storm water drains "A" and "C" were completed in November 1947. The contract for construction of the Heart Mountain power plant was 93 percent completed. The Heart Mountain-Garland 69-kilovolt transmission line was 51 percent completed.

Construction began early in the fiscal year under three contracts for most of the Ralston lateral, sublaterals, and North Alkali Creek drain, with more than 50 percent of the contract being completed. A contract for a concrete chute and appurtenances for the Willwood canal was awarded in May. Transmission lines unit: Construction of the Williston-Garrison Dam 115-kilovolt transmission line continued. Notice to proceed with construction of a 7,500-kilovolt-ampere substation at Beulah, N. Dak., was issued in May.

Power.—Twelve additional rural electric cooperatives in Montana and North Dakota were provided electric service during the fiscal year, bringing the total number in the region now served to 16. Negotiations have been completed or are under way for future service to 14 more.

Operation and maintenance.—A combination water service and repayment contract has been approved and signed by the Savage Irrigation District, and awaits validation by the court. Negotiations were conducted with the city of Dickinson for a water supply contract from Dickinson Reservoir and a resolution approving it was unanimously passed by the board of city commissioners. The contract was declared valid by the North Dakota Supreme Court.

An analysis is being made of municipal water supply problems within the Missouri Basin in order that the needs of municipalities for adequate water supplies can be given full consideration. Financial readjustment investigations were completed for the Frannie division of the Shoshone project, the Belle Fourche project, and the Malta and Glasgow divisions of the Milk River project. Negotiation of proposed amendatory contracts with the respective irrigation districts was virtually completed and agreement reached on principal contract terms. Notification of availability of water for the 1948 irrigation season and announcement of a 7-year development period were issued to the water users of the Dodson pumping unit. Notices were issued to the city of Rapid City, S. Dak., and the Rapid Valley Conservancy District announcing availability of water from Deerfield Reservoir and amounts of water charges for the year 1948.

Irrigation by sprinkler methods is being studied on the Bowbells and Huron farms. Memoranda of understanding covering cooperative work have been completed with North Dakota Agricultural College, South Dakota State College, and Montana State College.

Eighty-six farm units comprising 10,000 acres were opened to settlement on the Riverton project and Heart Mountain division of the Shoshone project. Qualified veterans of World War II were established on these units, and they were able to make exceptional progress in the development of their farms with the help of land development and other settler assistance programs carried out by the Bureau of Reclamation and other agencies. Farm unit plats and public notices have been prepared to open approximately 49 units at Riverton and 105 units at Heart Mountain early in fiscal year 1949. Detailed reports are being prepared in several districts for settlement of lands now in private ownership. The Extension Service and the Bureau of Reclamation are preparing a cooperative plan in the settler assistance program on the Heart River unit near Bismarck, N. Dak.

REGION 7

Within the boundaries of region 7 lie the three lower subbasins of the Missouri River Basin as well as the upper reaches of the Arkansas River into which 34 million dollars of reclamation funds were poured this fiscal year to bring about the greatest amount of construction since the region was formed. At the beginning of the fiscal year 27.8 million dollars were available for planning, construction, and operation and maintenance, but supplemental amounts of 4.2 million dollars and 3.1 million dollars were received to swell the total to 35.1 million dollars. At the close of the fiscal year only $900,000 of unobligated funds were carried over to the new fiscal year, most of which had been earmarked for flood control dams for which very little preparation planning had been made when Congress appropriated the funds soon after the beginning of the fiscal year.

Construction.—Construction was continued on the Colorado-Big Thompson project, where the Ramshorn and Prospect Mountain tunnels were completed, Granby and Horsetooth Reservoirs were well advanced and work was started on Olympus Dam and the Horsetooth feeder canal; on Kortes unit where water was diverted through the diversion tunnel and the first mass concrete was poured in the dam; on Frenchman-Cambridge unit where earthfill for Enders Dam was continued and construction started on Medicine Creek Dam, Cambridge diversion dam and Meeker canal rehabilitation; and on the Kendrick and Mirage Flats projects where minor force account and contract work was continued.

Active construction was started during the year on Cedar Bluff, Glendo, Narrows, St. Francis, and the Transmission Lines units. On the Bostwick unit formation of a district in Nebraska was accomplished but failure to complete the repayment contract prevented start of construction features expected to be under way during fiscal year 1948.

Power.—The power activities of the region have consisted of operation and maintenance of the Seminoe, Guernsey, and Lingle power plants in the North Platte River district, and the Green Mountain plant in the South Platte River district.

The four hydroelectric plants in the region generated 291 million kilowatt-hours of electrical energy, 282 million kilowatt-hours of which was sold to municipalities, REA Cooperatives, industrial plants, and public utilities for gross revenue of $1,772,600.

The outstanding problem encountered during the past year was the rapid rate of load growth to be cared for by the existing power plants. Little relief can be expected until fiscal year 1950 when the Kortes power plant with its 36,000 kilowatt installed capacity is completed.

Irrigation.—Completion of the Alva B. Adams tunnel late in fiscal year 1947 allowed the diversion of western slope water to be used for irrigation purposes in the Colorado Big Thompson project for the first time in August 1947. The acquisition by the Government of the Meeker canal from private owners and the temporary rehabilitation of the old structures to serve water users permitted the irrigation of 2,200 acres of land in the Frenchman-Cambridge unit during the year.

At the close of the fiscal year 1948, irrigation in region 7 reached a total of 216,000 acres. Approximately 200,000 acres were irrigated on the Bureau's North Platte project in Wyoming and Nebraska, 4,000 on the Kendrick in Wyoming, 10,000 on the Mirage Flats project, and 2,000 on the Frenchman-Cambridge unit in Nebraska. In addition, supplemental water was delivered to 30,000 acres of the Northern Colorado Conservancy District lands, and to 109,000 acres of Warren Act lands.

Planning.—Current investigation reports are being processed on the six river basins. The Lower Platte River Basin report and the interim reports of the potential Blue-South Platte and Gunnison-Arkansas projects are virtually complete and are in the process of being reproduced. The two projects will allow for the importation of Colorado River water to meet irrigation and municipal water deficiencies in Colorado east of the Rockies, provide generation of a large bloc of sorely needed hydroelectric power as well as flood control and sedimentation benefits.

Division of Power

WALTON SEYMOUR, *Director*

THE power operations of the Department of the Interior expanded rapidly during the fiscal year. Production of energy for sale totaled 19.6 billion kilowatt-hours, 20 percent greater than the previous year's total of 16.3 billion kilowatt-hours. Revenues were over $43,000,000 in 1948.

This growing power business is one of the major responsibilities of the Secretary of the Interior. The Division of Power assists the Secretary in a staff capacity in supervising the power activities of the Department.

Interior's power business is carried out under policies laid down by the Congress which direct the Secretary to recognize the special character of the marketing responsibility associated with the electric power producing facilities which are owned by the Federal Government.

Three fundamental principles have been firmly established in existing legislation:

1. Preference is to be given in the sale of power to States, counties, municipalities, and nonprofit cooperative organizations of citizens or farmers.
2. The power is to be sold on a basis which will assure its widespread use at the lowest possible rates consistent with sound business principles.
3. The power is to be sold at rates which will cover its cost.

The Department of the Interior and all of its agencies engaged in power activities have firmly supported these principles and are guided by them in all of their marketing work.

The electric power which is generated at Federally owned projects constitutes a significant energy resource. These legislative policies are designed to preserve this resource for the public welfare and to avoid its monopolization.

In addition to performing its staff functions for the Secretary, the Division of Power has done significant work toward marketing the power output of the flood-control projects being built by the United States Corps of Engineers in the Southeast. Progress was made during the year toward completion of a definitive contract with TVA under which TVA will purchase the power from the Dale Hollow, Center Hill, and Wolf Creek projects in the basin of the Cumberland

River. Dale Hollow is scheduled for initial operation in December 1948, Center Hill in March 1951, and Wolf Creek in the fall of 1951.

During the year negotiations were practically completed by the Division with the Georgia Power Co. for the sale to the company of the power output of the Allatoona project on the Etowah River. A definitive contract will be executed shortly after the end of the fiscal year. By its terms the United States will receive about a million dollars a year in revenues. The contract also assures the availability of a supply of firm energy for sale to public bodies and cooperatives in excess of the firm power capability of the project. Allatoona will be completed in 1950.

Bonneville Power Administration

PAUL J. RAVER, *Administrator*

Management of the Enterprise

ALTHOUGH the program for adequate extension of the Bonneville Power Administration system was at a definitely retarded pace, power sales and net revenues continued to show lively growth during the fiscal year.

ENERGY PRODUCTION

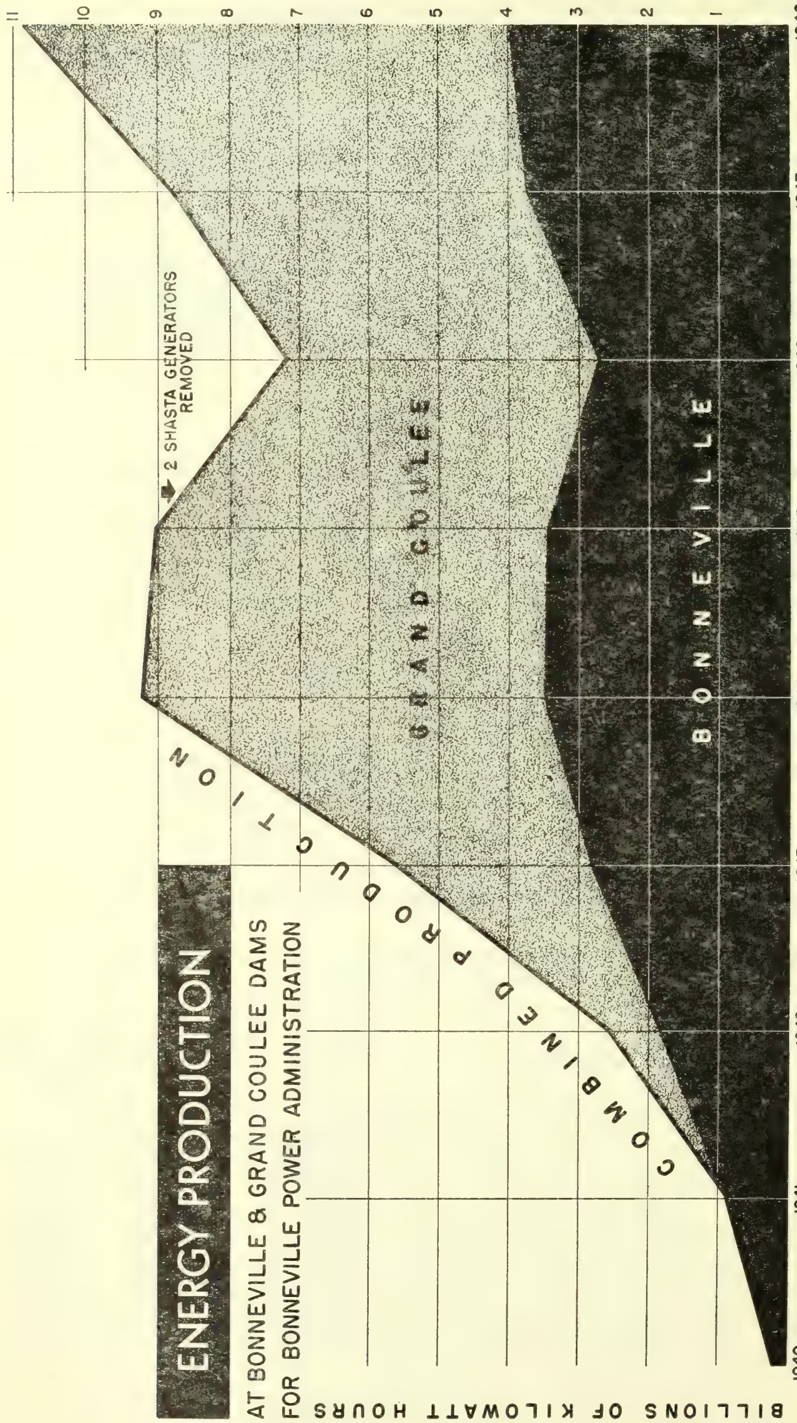
Energy produced at Bonneville and Grand Coulee plants during the year for the first time exceeded 10 billion kilowatt-hours. The total of 10,885,907,000 kilowatt-hours exceeded the peak war year of 1944 by 17.8 percent and represented 61 percent of total energy produced in the States of Oregon and Washington during the 12-month period.

Energy generation during June 1948 and for the year would have been approximately 200 million kilowatt-hours greater if the most acute flood condition in 50 years had not occurred in May and June. High water and reduced operating head drastically curtailed the power output at both Grand Coulee and Bonneville Dams.

Table 1, generation at Bonneville and Grand Coulee Dams, shows energy production from the beginning of operations to the end of fiscal 1948, and table 2, electric energy account, presents an explanation of energy received and delivered by the Administration.

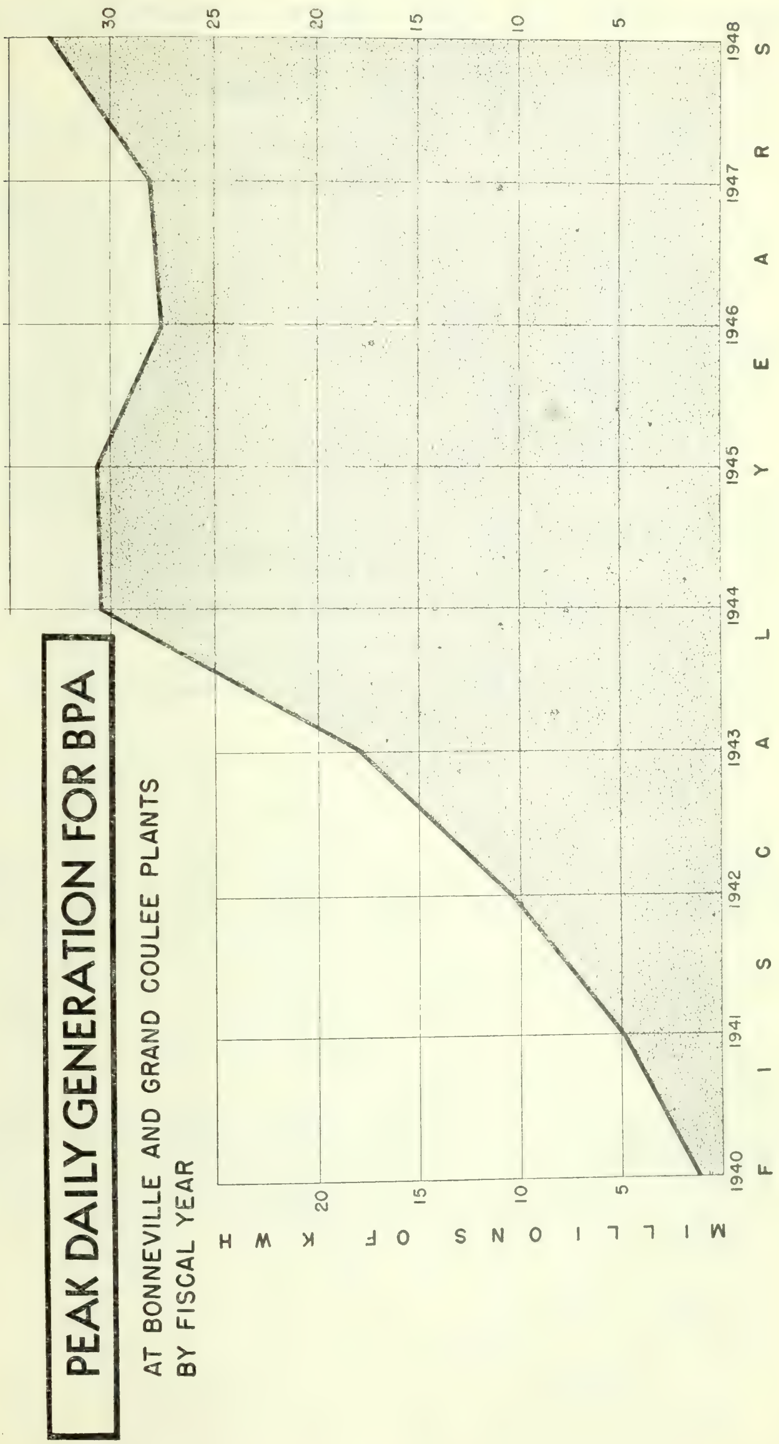
TABLE 1.—*Bonneville Power Administration generation of Bonneville and Grand Coulee plants, 1938–48*

Fiscal years ending June 30	Bonneville Dam generation	Grand Coulee Dam generation	Total generation for Bonneville Power Administration
	Kilowatt-hours	*Kilowatt-hours*	*Kilowatt-hours*
1939	34, 874, 138		34, 874, 138
1940	208, 426, 077		208, 426, 077
1941	804, 177, 000	7, 455, 000	901, 632, 000
1942	1, 807, 309, 000	741, 844, 249	2, 549, 153, 249
1943	2, 801, 480, 400	2, 816, 955, 729	5. 618, 436, 129
1944	3, 488, 873, 992	5, 750, 949, 460	9, 239, 823, 452
1945	3, 391, 127, 400	5, 660, 445, 960	9, 051, 573, 360
1946	2, 674, 834, 000	3, 561, 329, 280	6, 236, 163, 280
1947	3, 695, 255, 000	5, 058, 482, 320	8, 753, 737, 320
1948	3, 991, 860, 000	6, 894, 047, 000	10, 885, 907, 000
Total	22, 988, 217, 007	30, 491, 508, 998	53, 479, 726, 005



ENERGY PRODUCTION

AT BONNEVILLE & GRAND COULEE DAMS FOR BONNEVILLE POWER ADMINISTRATION



PEAK DAILY GENERATION FOR BPA

AT BONNEVILLE AND GRAND COULEE PLANTS
BY FISCAL YEAR

TABLE 2.—*Bonneville Power Administration electric energy account, fiscal year ended June 30, 1948*

Energy received (kilowatt-hours):	
Energy generated for Bonneville Power Administration:	
Bonneville	3, 991, 860, 000
Grand Coulee	6, 894, 047, 000
Total	10, 885, 907, 000
Power purchased and interchanged (in)	286, 310, 725
Total received	11, 172, 217, 725
Energy delivered (kilowatt-hours):	
Sales	10, 272, 257, 111
Power interchanged (out)	106, 983, 377
Used by administration	13, 795, 897
Total delivered	10, 393, 036, 385
Energy losses	779, 181, 340
Percent of total energy received	7. 0
Maximum demand on Bonneville and Grand Coulee plants (kilowatt) May 11, 1948, 10–11 a. m.	1, 610, 000
Load factor—total generated for Bonneville Power Administration	77. 0

TABLE 3.—*Electric energy sales by class of customer, fiscal years 1939–48*

[Megawatt-hours]

Class of customer	1939 and 1940	1941	1942	1943	1944
Industry:					
Aluminum		522, 982	1, 845, 249	3, 588, 848	5, 453, 893
Other industry	21	4, 790	76, 580	464, 309	934, 588
Military establishments		18	2, 575	42, 887	87, 889
Publicly owned utilities	3, 108	32, 134	142, 491	435, 289	727, 642
Privately owned utilities	218, 842	317, 713	357, 704	739, 076	1, 467, 304
Total	221, 971	877, 637	2, 424, 599	5, 270, 409	8, 671, 316

Class of customer	1945	1946	1947	1948	Total to June 30, 1948
Industry:					
Aluminum	4, 667, 381	2, 492, 985	4, 212, 413	4, 902, 465	27, 686, 216
Other industry	878, 896	739, 408	600, 131	609, 534	4, 308, 257
Military establishments	85, 828	59, 970	26, 557	37, 379	343, 103
Publicly owned utilities	823, 822	635, 531	1, 044, 901	1, 546, 147	5, 391, 065
Privately owned utilities	2, 057, 203	1, 902, 990	2, 377, 887	3, 176, 732	12, 615, 451
Total	8, 513, 130	5, 830, 884	8, 261, 889	10, 272, 257	50, 344, 092

TABLE 4.—*Energy deliveries to customers of the Bonneville Power Administration, year ending June 30, 1948*

DELIVERIES UNDER POWER CONTRACTS

Customers and points of delivery	Energy deliveries for year,[1] kilowatt-hours	Date of initial service
Publicly owned utilities:		
Municipalities:		
Bandon, Oreg	1,431,796	February 1947.
Canby, Oreg	4,566,000	February 1940.
Cascade Locks, Oreg	5,097,600	March 1939.
Centralia, Wash	1,555,000	January 1941.
Drain, Oreg	3,364,200	April 1941.
Ellensburg, Wash	13,654,000	May 1941.
Eugene, Oreg	35,445,988	December 1940.[2]
Forest Grove, Oreg	16,021,200	November 1939.
Grand Coulee, Wash	11,055,000	January 1942.
McMinnville, Oreg	29,406,000	October 1940.
Milton, Oreg	3,938,400	June 1946.
Monmouth, Oreg	4,510,400	December 1940.
Seattle, Wash	161,017,000	May 1941.[2]
Tacoma, Wash	356,004,000	March 1941.[2]
Total municipalities	647,066,584	
Public utility districts:		
Benton County public utility district No. 1	34,518,645	September 1946.
Benton City		Do.
Kennewick 2.3 kilovolts		Do.
Kennewick 69 kilovolts		Do.
Prosser		Do.
Central Lincoln peoples' utility district	26,225,512	
North Bend		February 1947.
Toledo		October 1946.
Clark County public utility district No. 1	160,592,730	
Cherry Grove		February 1948.
Hall Substation		Do.
Mill Plain		September 1942.
Ridgefield		February 1948.
Tower No. 6		May 1946.
Vancouver Shipyard		Do.
Washougal		February 1948.
Dredge		October 1947.
Clatskanie peoples' utility district	4,923,800	March 1943.
Cowlitz County public utility district No. 1	235,254,900	
Longview		August 1941.
Vader		May 1948.
Douglas County public utility district No. 1	5,086,200	
Brewster		August 1946.
Bridgeport		October 1947.
Franklin County public utility district No. 1	2,418,338	April 1948.
Grant County public utility district No. 2	52,949,968	
Coulee City		August 1942.
Ephrata		March 1947.
Moses Lake		October 1946.
Stratford		Do.
Grays Harbor public utility district No. 1	97,556,000	November 1940.
Kittitas County public utility district No. 1	2,544,960	June 1941.
Klickitat County public utility district No. 1	2,118,100	November 1940.
Lewis County public utility district No. 1	11,702,400	
Elbe		October 1945.
Morton		December 1947.
Mossyrock		May 1941.
Okanogan County public utility district No. 1	47,630,580	August 1946.
Pacific County public utility district No. 2	31,398,821	
Naselle		November 1940.
Raymond		October 1940.
Pend Oreille County public utility district No. 1	2,853,600	February 1948.
Skamania County public utility district No. 1	8,257,088	
North Bonneville		January 1940.
White Salmon		April 1942.
Bonneville Dam		January 1943.
Tillamook County peoples' utility district	1,456,040	
Beaver		October 1946.
Trask		July 1947.
Wahkiakum County public utility district No. 1	6,357,600	
Cathlamet		November 1940.
Svenson		Do.
Total public utility districts	733,845,282	

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[1] Includes energy deliveries carried on exchange accounts.

TABLE 4.—*Energy deliveries to customers of the Bonneville Power Administration, year ending June 30, 1948*—Continued

DELIVERIES UNDER POWER CONTRACTS—Continued

Customers and points of delivery	Energy deliveries for year, kilowatt-hours	Date of initial service
Publicly owned utilities—Continued		
Cooperatives:		
Benton-Lincoln Electric Cooperative	9, 845, 082	
Albany		October 1940.
Harrisburg		May 1946.
Toledo		December 1946.
Wren		April 1947.
Benton Rural Electric Association	10, 014, 720	
Grandview		July 1942.
North McNary		September 1947.
Prosser		July 1942.
Big Bend Electric Cooperative	4, 399, 964	
Delight		August 1945.
Ritzville		August 1942.
Blachly-Lane Electric Cooperative	1, 623, 000	September 1945.
Clearwater Valley Light & Power Association	10, 890, 900	
Craigmont		November 1947.
Juliaetta		August 1942.
Orofino		March 1947.
Upper Tammany		May 1948.
Columbia County Rural Electric Association	5, 354, 280	
Dayton		May 1948.
Walla Walla		July 1941.
Coos-Curry Electric Cooperative	3, 237, 800	February 1947.
Douglas Electric Cooperative	7, 871, 730	
Brockway Junction		September 1941.
Drain-Oakland		July 1941.
Krewson		October 1946.
Leona		December 1947.
Hood River Electric Cooperative	5, 750, 400	May 1946.
Idaho County Light & Power Cooperative Association	1, 911, 150	
Grangeville		August 1942.
Kamiah		July 1947.
Inland Empire Rural Electric Association	23, 819, 164	
Colfax		June 1946.
Geiger		Do.
Pomeroy		July 1947.
Pullman		July 1946.
Spring Valley		June 1946.
St. John		Do.
Valley Way		Do.
Kootenai County Rural Electric Association	4, 431, 116	
Bayview		February 1948.
Coeur d'Alene		August 1942.
Harrison Flats		Do.
Lane County Electric Cooperative	8, 075, 820	March 1946.
Lincoln Electric Cooperative	6, 423, 000	
Creston 12.5 kilovolts		June 1947.
Creston 33 kilovolts		April 1942.
Nespelem Valley Electric Cooperative	2, 418, 000	September 1941.
Northern Idaho Rural Electrical Rehabilitation Association	3, 115, 494	
Bayview		April 1948.
Newport		May 1943.
Okanogan County Electric Cooperative	1, 187, 040	August 1942.
Pend Oreille Electric Cooperative	1, 638, 360	May 1943.
Salem Electric	19, 471, 800	
Alumina Plant		July 1947.
North		October 1945.
West		March 1941.
Stevens County Electric Cooperative	6, 791, 006	
Addy		August 1942.
Evans		Do.
Spirit		November 1947.
Umatilla Electric Cooperative	8, 005, 572	
Depot		July 1942.
Substation		February 1943.
Wasco Electric Cooperative	6, 192, 300	
The Dalles		May 1941.
Tygh Valley		November 1947.
West Oregon Electric Cooperative	4, 096, 593	
Olney		February 1941.
Vernonia		March 1947.
Scoggins Valley		September 1947.
Total cooperatives	156, 564, 291	

TABLE 4.—*Energy deliveries to customers of the Bonneville Power Administration, year ending June 30, 1948*—Continued

DELIVERIES UNDER POWER CONTRACTS—Continued

Customers and points of delivery	Energy deliveries for year,[1] kilowatt-hours	Date of initial service
Other:		
Oregon State College	2, 008, 248	November 1946.
Vera Irrigation District No. 15	6, 662, 760	December 1945.
Total, other	8, 671, 008	
Total, publicly owned utilities	1, 546, 147, 165	
Privately owned utilities:		
British Columbia Electric Railway Co., Ltd	75, 660, 436	August 1947.
Mountain States Power Co	98, 571, 246	
Salem area A		February 1947.
Salem area B		September 1947.
Tillamook		August 1943.[2]
Pacific Power & Light Co.—Astoria	51, 268, 000	June 1941.
Portland General Electric Co	1, 034, 997, 308	December 1939.
Puget Sound Power & Light Co	847, 514, 000	October 1943.
Washington Water Power-Pacific Power & Light Co	580, 773, 000	July 1942.[2]
Four Company Pool[3]	487, 947, 929	September 1947.
Total, privately owned utilities	3, 176, 731, 919	
Military establishments	37, 378, 757	
Industries:		
Aluminum:		
Aluminum Company of America	1, 502, 248, 000	September 1940.
Permanente Metals Corporation:		
Spokane Aluminum Fabrication	193, 830, 000	December 1942.[4]
Spokane Aluminum Reduction	1, 725, 180, 000	May 1942.[4]
Tacoma Aluminum Reduction	229, 855, 000	August 1942.[4]
Reynolds Metals Co.:		
Longview	106, 632, 000	August 1941.
Troutdale	1, 144, 720, 000	May 1942.[4]
Other industries:		
Electro-Metallurgical Co	118, 686, 000	July 1942.
Pacific Carbide and Alloys	21, 152, 000	November 1940.
Pennsylvania Salt Manufacturing Co.:		
Plant No. 1	31, 036, 000	November 1941.
Plant No. 2	31, 420, 800	June 1947.
Miscellaneous (9)	407, 239, 470	
Total industries	5, 511, 999, 270	
Total sales of electric energy	10, 272, 257, 112	

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[2] Date of initial delivery of energy to customer; intermittent service.

[3] Includes Washington Water Power Co., Pacific Power & Light Co., Puget Sound Power & Light Co., and Portland General Electric Co.; nonfirm energy scheduled to Washington Water Power Co.

[4] Date of initial service to plant regardless of ownership.

Three new generating units were added at Grand Coulee during October 1947, February and April 1948. Present installed capacity at the two plants is now 1,490,400 kilowatts name plate rating, with safe continuous capacity under favorable operating head conditions of 1,644,000 kilowatts. The maximum coincidental demand on these two plants during the year was 1,610,000 kilowatts, occurring during May 1948. This was an increase of 13 percent over the wartime peak of 1,427,000 kilowatts in January 1945.

ENERGY DELIVERIES

During the Administration's 10 years of operation, ending June 30, 1948, the system delivered 50,344,092,000 kilowatt-hours of energy, of which 20 percent represented sales during the fiscal year 1948. Energy sales by class of customer for each of the years are shown in table 3.

During 1948 the Administration served 88 wholesale customers, of which 57 were publicly owned utilities, 6 were privately owned utilities, 7 were military establishments, and 18 were industries. Service was added for four new customers, three publicly owned utilities and one privately owned utility, and discontinued for two customers, one a military establishment and one an industry. Twenty-seven additional delivery points were established and one discontinued. Table 4 shows the detail of energy deliveries to customers during fiscal 1948.

REVENUES

Power sales during the fiscal year 1948 reached an all-time peak with annual gross operating revenues of the Administration approaching $25,000,000. Revenues showed an increase of more than $2,500,000 over those for fiscal year 1947, and were $1,523,692 greater than in the wartime peak year of 1945.

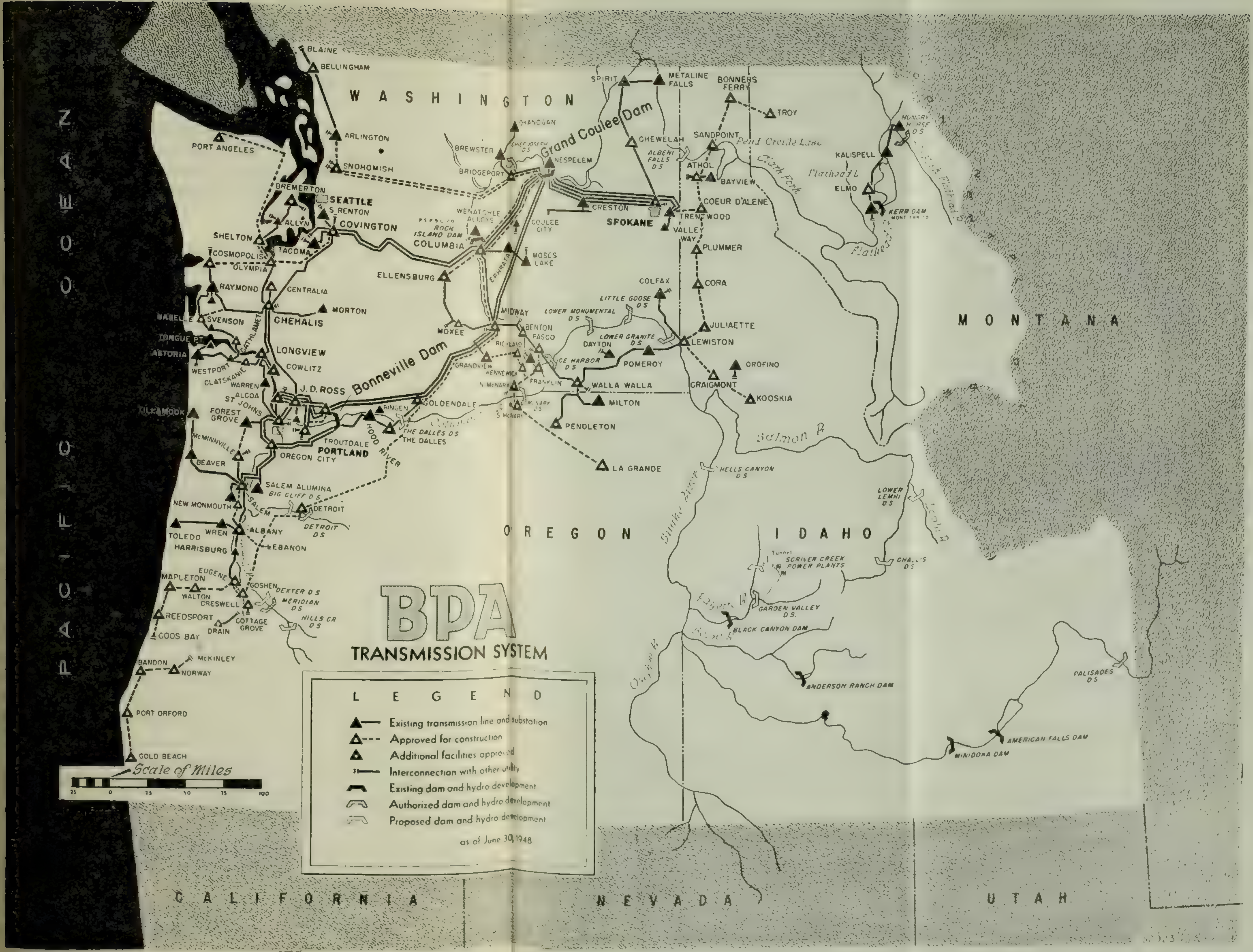
Gross operating revenues increased in all categories of Bonneville customers, with sales to utility companies showing an increase of $1,505,382 and sales to publicly owned utilities an increase of $1,539,355. Aluminum and other industries, including military establishments, showed an increase of $1,487,420. These increases of $4,532,157 in electric sales, together with an increase of $103,595 in miscellaneous electric revenues and a decrease of $2,012,972 in war-contract cancellation charges, account for the net increase of $2,622,780 in gross revenues over the fiscal year 1947.

Percentagewise, industries, including military establishments, accounted for 50.4 percent of 1948 gross revenues, publicly owned utilities 17.61, privately owned utilities 31.14, and other electric revenue 0.79 percent.

FOURTH ANNUAL AUDIT

The Administration's accounts were given their fourth annual audit by Arthur Andersen & Co. The report confirmed the Administration's records which show a return of $9,136,181 to the United States Treasury for year ending June 30, 1948, over and above all expenses of operation, maintenance, depreciation, and interest for the year. Total revenues from the beginning of operations to June 30, 1948, were $129,866,166, and cumulative surplus net power revenues from the Government's investment in the Columbia River reached $32,069,325, as of June 30, 1948, after provision for all expenses of operation, including interest and depreciation.

As of June 30, 1948, the plant accounts of the two dams and the transmission system represented an original cost of 448 million dollars,



BPA
TRANSMISSION SYSTEM
LEGEND
Existing transmission line and substation
Approved for construction
Additional facilities approved
Interconnection with other utility
Existing dam and hydro development
Authorized dam and hydro development
Proposed dam and hydro development
as of June 30, 1948
Scale of Miles
25 0 25 50 75 100
PACIFIC OCEAN
WASHINGTON
OREGON
IDAHO
MONTANA
CALIFORNIA
NEVADA
UTAH
Grand Coulee Dam
Bonneville Dam
BLAINE
BELLINGHAM
ARLINGTON
SNOHOMISH
PORT ANGELES
BREMERTON
SEATTLE
S. RENTON
COVINGTON
ALLYN
SHELTON
TACOMA
COSMOPOLIS
OLYMPIA
RAYMOND
CENTRALIA
MORTON
CHEHALIS
NASELLE
SVENSON
TONGUE PT
ASTORIA
CATHLAMET
LONGVIEW
COWLITZ
WESTPORT
CLATSKANIE
WARREN
ALCOA
ST JOHNS
J. D. ROSS
TILLAMOOK
FOREST GROVE
McMINNVILLE
BEAVER
OREGON CITY
PORTLAND
TROUTDALE
HOOD RIVER
SALEM ALUMINA
BIG CLIFF D S
SALEM
DETROIT
DETROIT D S
NEW MONMOUTH
TOLEDO
WREN
ALBANY
HARRISBURG
LEBANON
EUGENE
MAPLETON
WALTON
CRESWELL
GOSHEN
DEXTER D S
MERIDIAN D S
HILLS CR D S
COTTAGE GROVE
DRAIN
REEDSPORT
COOS BAY
BANDON
McKINLEY
NORWAY
PORT ORFORD
GOLD BEACH
OKANOGAN
CHIEF JOSEPH D S
BREWSTER
BRIDGEPORT
NESPELEM
WENATCHEE ALLOYS
ROCK ISLAND DAM
COLUMBIA
COULEE CITY
EPHRATA
MOSES LAKE
ELLENSBURG
MOXEE
MIDWAY
BENTON
PASCO
RICHLAND
GRANDVIEW
KENNEWICK
FRANKLIN
N. McNARY
S. McNARY
McNARY D S
ICE HARBOR D S
RINGEN
GOLDENDALE
THE DALLES D S
THE DALLES
LOWER MONUMENTAL D S
LITTLE GOOSE D S
LOWER GRANITE D S
DAYTON
POMEROY
WALLA WALLA
MILTON
PENDLETON
LA GRANDE
SPIRIT
METALINE FALLS
CHEWELAH
ALBENI FALLS D S
CRESTON
SPOKANE
TRENTWOOD
VALLEY WAY
COLFAX
PLUMMER
CORA
JULIAETTE
LEWISTON
CRAIGMONT
OROFINO
KOOSKIA
BONNERS FERRY
TROY
SANDPOINT
Pend Oreille Lake
ATHOL
BAYVIEW
COEUR D'ALENE
Clark Fork
HUNGRY HORSE D S
KALISPELL
Flathead L
ELMO
KERR DAM
Flathead R
Salmon R
HELLS CANYON D S
Snake River
LOWER LEMHI D S
Tunnel
SCRIVER CREEK POWER PLANTS
GARDEN VALLEY D S
BLACK CANYON DAM
CHALLIS D S
ANDERSON RANCH DAM
PALISADES D S
AMERICAN FALLS DAM
MINIDOKA DAM

of which 317 million dollars was allocated to power and 131 million dollars to irrigation, navigation, and other nonpower purposes. Gross investment of the Federal Government in the power phases of the operations of the three agencies totaled $396,356,000 at June 30, 1948, including appropriations, WPA expenditures, and interest accumulations. Interest accumulation alone amounted to $54,785,000 as of this date. Of this amount $122,668,000 of cash receipts from power sales and miscellaneous operations had been returned to the Treasury, leaving a net unpaid investment by the Government in the power operation of $273,688,000.

Transmission System

At the close of the fiscal year 1948, the Bonneville Power Administration had a total of 3,298.3 miles of transmission line in operation. Eighty-six substations had a transformer capacity of 2,765,333 kilovolt-amperes.

This included a net gain of 322.2 miles of line, and 552,400 kilovolt-amperes of transformers added during the fiscal year.

Substantial as this total system capacity was, it was insufficient to meet the power requirements of the Administration's utility and industrial customers with a reasonable margin of safety.

In some load centers of the region the lack of transmission and substation capacity was particularly acute. The lack of adequate reserves in the form of loop service, and multiple points of delivery, coupled with substandard maintenance, faced power consumers in the Columbia Basin with the threat of pay-roll and production losses arising from poor voltage conditions and service instability.

MAJOR CONSTRUCTION FOR POWER-DEFICIT AREAS

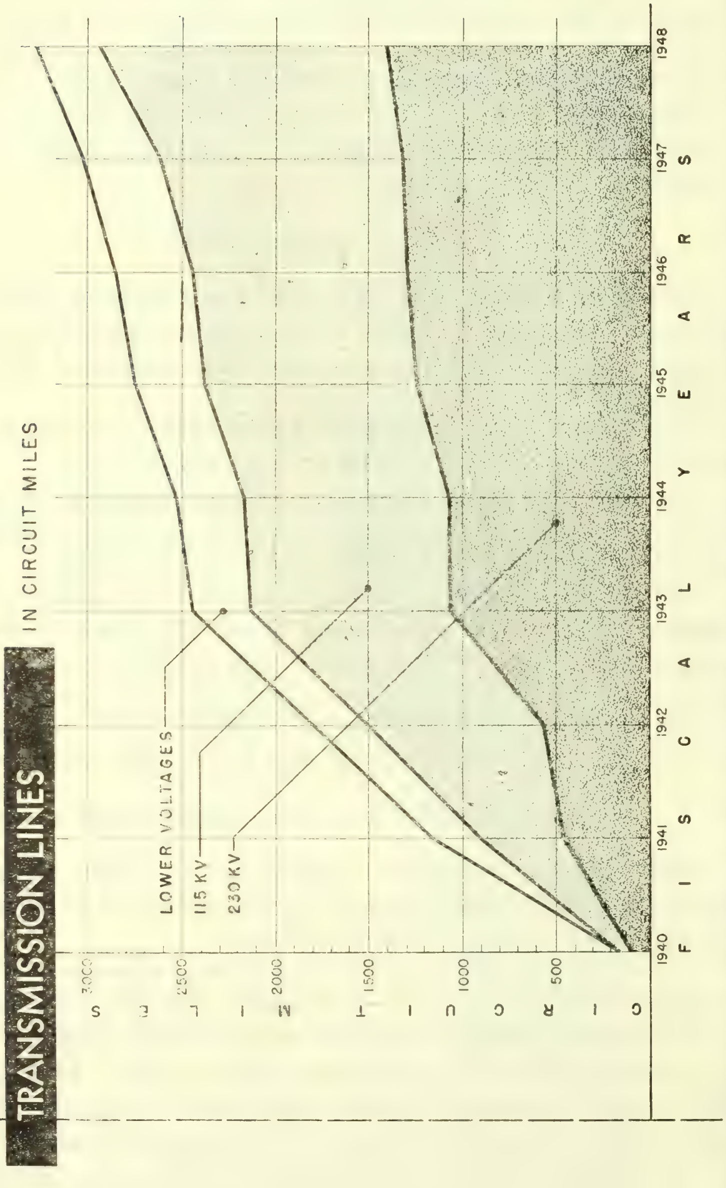
Major construction projects during the year were directed toward bringing relief to those areas in Washington and Oregon where the power deficit was becoming most critical.

One of these important projects was the continuation of the Grand Coulee-Snohomish facility—a 170-mile, 230-kilovolt steel transmission line from Grand Coulee Dam to Snohomish, Wash.

Surveys of this line were started May 24, 1947. Construction was pushed through fiscal 1948 concurrently with the installation of one of the world's largest substations at the Snohomish terminus.

By the close of fiscal 1948, work on the line was 57 percent complete, while the Snohomish substation had been energized through connections with the Bonneville and Seattle City Light systems to the south.

This line and substation will serve the heavily populous area in the vicinity of Seattle and Everett, Wash., where power is already in



TRANSMISSION LINES

IN CIRCUIT MILES

short supply. When complete, the facility will be of sufficient capacity to provide a major transmission link between Grand Coulee Dam and load centers in the State of Oregon. For these reasons, this work was given highest priority by the Administration.

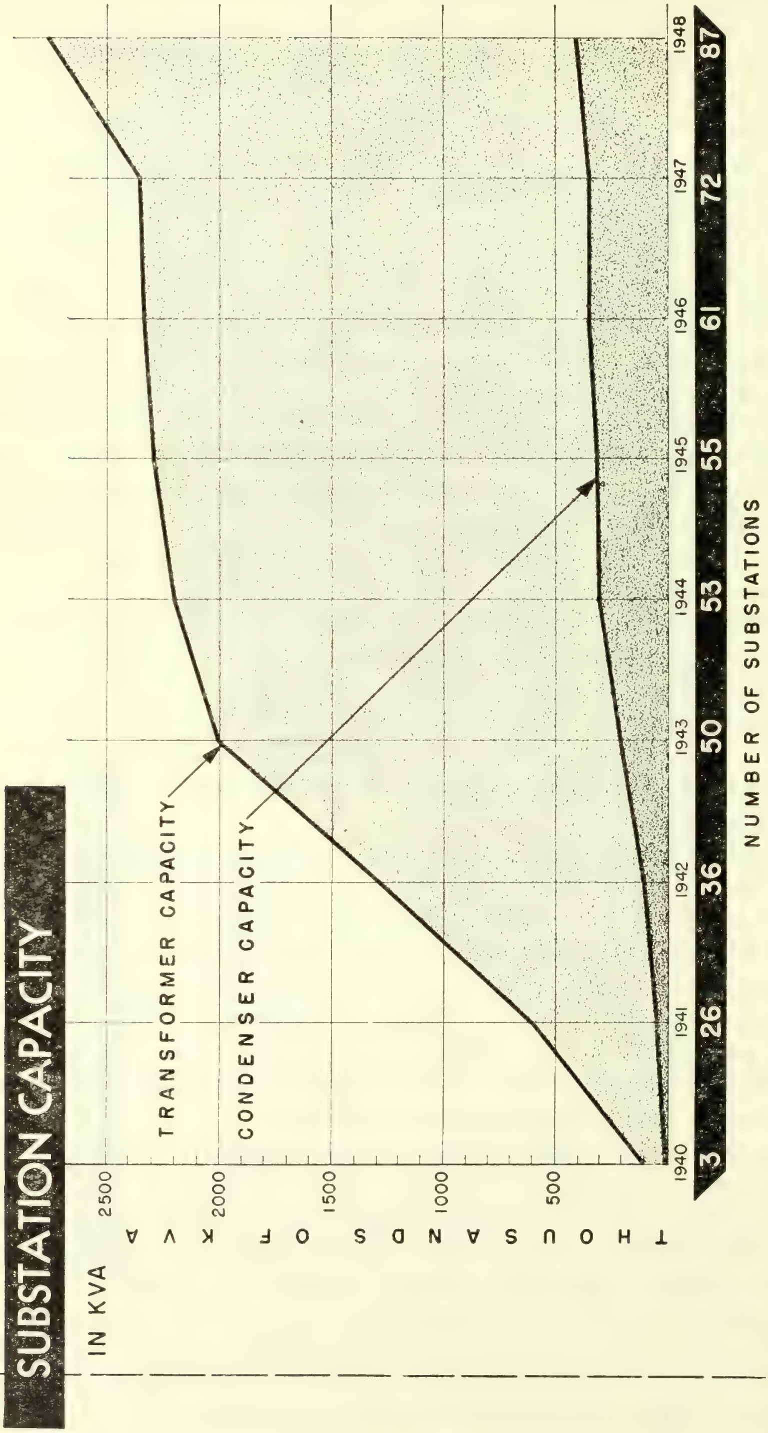
A second important facility, also in northwest Washington, is the 71-mile, 230-kilovolt, Arlington-Blaine transmission line and switching station, which was energized on August 10, 1947. This line, originally authorized as a war measure, will be used to bring surplus power from the Bridge River plant of the British Columbia Electric Co. system to the load centers of Washington and Oregon during the critical years of 1949–51, when adverse water conditions in the Columbia watershed, and the consequent need for additional reserves of generation may bring serious trouble to the region's power consumers.

The Shelton-Allyn, 16-mile, 115-kilovolt line, and a 6,000-kilovolt-ampere Shelton substation were energized September 4, 1947, on the Olympic Peninsula. This relieved the industrial demand in the Shelton area and provided the first leg of a circuit which will ultimately be pushed as far as Port Angeles, where there is currently a shortage of industrial energy.

Other power supply deficits were relieved in the State of Washington by the energization of The Dalles-Goldendale, 115-kilovolt line, and 6,000-kilovolt-ampere substation on January 23, 1948, and by the completion of the Spokane-Spirit-Metaline Falls line on February 6, 1948. This latter facility, 103 miles long, relieved the demand for power by the mining enterprises in the Metaline district of Washington and Idaho.

In Oregon, a beginning was made on bringing adequate service to the State's southwest area, where the region's timber industry now centers, and where population gains have totaled 60 percent in the past 8 years. A substation of 7,500 kilovolt-amperes capacity was placed in operation at Toledo on the coast, and a 115-kilovolt line between Cottage Grove and Drain, in the upper Willamette Valley, was energized with a 9,000-kilovolt-ampere substation at Drain. While these facilities were of some help, they were far from adequate in meeting the load requirements of the area.

As part of the Congress' longer-range program to relieve the northwest power shortage, facilities were built during the year to bring construction power to Hungry Horse and McNary dam sites. Sections of a 60-mile line from Kerr Dam at the lower end of Flathead Lake to the Hungry Horse dam site were energized on December 14, 1947, and March 11, 1948, at 33 kilovolts and at 115 kilovolts on June 27, 1948. Two short tap lines and two substations were energized on July 29, 1947, and October 22, 1947, one on each side of the Columbia River, to bring power to McNary Dam construction.


SUBSTATION CAPACITY
IN KVA
THOUSANDS OF KVA
2500
2000
1500
1000
500
TRANSFORMER CAPACITY
CONDENSER CAPACITY
1940
1941
1942
1943
1944
1945
1946
1947
1948
3
26
36
50
53
55
61
72
87
NUMBER OF SUBSTATIONS

In spite of these extensions, it must be admitted that during 1948 the Bonneville Administration's transmission program fell seriously behind the demands put upon it by the business and population growth within the region.

CRITICAL LOAD ON SYSTEM

Loading of the transmission facilities beyond their designed limits, in an attempt to meet the demand for power, resulted, by year's end, in a number of serious operating problems.

One of these was the problem of voltage regulation, which was reflected in the service to industrial and household equipment requiring voltage maintained within fixed limits. The use of static capacitors was employed as a partial correction, but these were expensive, increased system costs, and did not entirely correct voltage variations. During the month of April 1948 voltage on the system was maintained by increasing the reactive generation of both Grand Coulee and Bonneville Dams; but this required decreasing power generation by 15,000 to 20,000 kilowatts, and so reduced the net power supply by that amount at times when it was needed.

System overloads also rendered the carrier-relay system of the Administration less effective, since, under these conditions, the relay warnings fail to distinguish between short circuits and overloads, particularly when the fault is at a remote point.

Phase comparison relaying was used as an intermediate corrective step. This type of relay recognizes the difference between heavy loads and faults, but has the inherent disadvantage of comparatively slow operation. Slow relay operation jeopardized system stability, due to the time required to clear faults.

Relaying by means of microwave appears to be a solution to this problem, as it has the advantages of phase comparison, but is much more rapid in operation.

Perhaps the most serious operating problem developing during the year as a result of overload was the approach to a condition of system instability. [When the transmission lines lack spare capacity, as they do when overloaded, the effects of local failures are spread to all parts of the system.] This unstable condition was exemplified during the winter 1947–48, when a local failure put two 230,000-volt Grand Coulee-Spokane lines out of service, and loads in excess of 400,000 kilowatts were dropped. While not frequent, loads of this order have been lost several times, primarily due to system instability.

Some idea of the constantly increasing loads can be obtained by a reference to the chart showing successive peaks of energy during the life of the Administration. A specific example of critical loading is the 240,000 kilowatts carried on the Bonneville-Troutdale, 230-kilovolt transmission line, normal loading being 180,000 kilowatts. At the Salem, Oreg., substation, a transformer bank with a nominal rating of 40,000 kilovolt-amperes carried 54,000 kilovolt-amperes. Covington, Wash., transformers, nominally rated 200,000, carried 248,000 kilovolt-amperes, and at St. Johns, Oreg., transformers with a capacity of 80,000 kilovolt-amperes were loaded to 110,000 kilovolt-amperes under forced cooling.

ADVERSE EFFECTS OF DEFERRING MAINTENANCE

Curtailment of preventive maintenance, first made necessary by the war, and subsequently by inadequate appropriation allowances, did not permit the Bonneville Power Administration to pursue normal measures against system deterioration. Tremendous postwar growth of loads carried by the facilities did not permit their removal from service during normal working hours for maintenance purposes. This meant that maintenance work must be done at night and on week ends, with an attendant heavy rise in costs for overtime.

At least one equipment failure during the year, directly attributable to lack of preventive maintenance, cost approximately $10,000 in repairs.

Lack of funds to replace pyrex insulators and split crossarms resulted in a rising trend of service failures on the system. Failure to inspect contacts of oil circuit breakers after a fixed number of operations and to clear brush on transmission-line right-of-way also added to the number of system failures. Reestablishment of normal maintenance and operation crews awaits favorable congressional action on appropriation requests.

Policy Problems and Recommendation

Substantial increase in sales during the year and rapid growth in the loads of preferred customers with contracts of some years' standing, coupled with inadequate construction of generation and transmission resulted, at year's end, in a sell-out of firm power supply from the Columbia River system, and in delays in arranging adequate service to some customers.

As of June 30, 1948, the Administration's load forecasts showed that the requirements to meet existing long-term firm commitments would leave no margin under minimum water conditions for sale to new customers until upstream storage becomes available from Hungry Horse Dam Reservoir, now scheduled for completion in the summer of 1952.

This situation made it impossible for the Administration to consider new commitments for firm power supply, since such supply must be guaranteed, and is limited by the possibility of minimum water conditions in the Columbia Basin.

Virtually the entire available supply of firm power from the Federal system had been committed, by the close of the year, on long-term contracts to the public agencies and the heavy electro-industries which had been attracted to the region by supplies of low-cost power.

These commitments included reserves for growth in public-agency loads.

The margin of firm power held in reserve for growth in loads of public agencies was sold on one-year contracts to the privately owned utility companies in the region for their use pending such time as it would be absorbed by the needs of the preferred agencies.

However, there remained for sale a considerable but uncertain and variable quantity of power which would be available during high-water seasons, and during low-water seasons in those years where better than minimum water conditions prevail. This amount of "interruptible power," over and above the firm power obtainable under minimum-year water conditions, is estimated to run as high as 400,000 or 500,000 kilowatts, depending on the characteristics of the load to be served.

TRANSMISSION SYSTEM OVERLOADED

The critical loading of the Federal transmission system posed a serious problem throughout the year. This was due primarily to the inadequacy of funds during the past several years to build needed transmission facilities. Because of the manpower situation and long deliveries of materials, this situation is expected to continue at least until 1952, even assuming sufficient funds will be available for the purpose.

The transmission problem would have been much more severe during the year if it had not been for the fact that the Federal grid has been designed in such a way as to make possible a high degree of pooling all power resources in the region regardless of their ownership.

The Northwest Power Pool continued its outstanding record for coordinated operation with heavy dependence on the Bonneville grid. Its membership, consisting of ten utilities, both publicly and privately owned, whose systems are linked through the medium of the Bonneville-Coulee transmission system, took full advantage of watershed diversities, load diversities, and the possibilities of pooling stand-by reserves.

Nevertheless, in several instances during the year, several transmission bottlenecks forced the Administration to draw upon its continuing emergency fund[1] in order to meet statutory requirements for service and to complete programs ordered by the Congress.

The continuing-fund authority was used with the following items: completion of The Dalles-Goldendale line for service to Klickitat

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[1] See sec. 11, Bonneville Act.

County PUD No. 1; installation of 20,000-kilovolt-ampere capacitors at Troutdale substation; installation of 7,500-kilovolt-ampere capacitor at Salem substation. It was also necessary to repair a synchronous condenser at the Salem substation which had failed under critical loading conditions. These installations firmed up the power-supply situation in the Portland and Eugene areas by the correction of serious voltage conditions.

Transmission emergencies were met in other cases by arrangement with utility customers to construct substation facilities which normally, under terms of the Federal statute and the Federal rate structure, should be provided by the Government. Such arrangements were made during the year with three public-utility districts, two electric cooperatives, and one power company.

On the policy level, this makeshift situation acted as a threat to the power policies enunciated by the Congress and the Bonneville Act. These conditions not only worked a hardship and loss upon Northwest power consumers, but contributed to a feeling of insecurity by business enterprises which had based their progress on the contractual relationships effected pursuant to the statute.

THE PROBLEM OF RISING COSTS

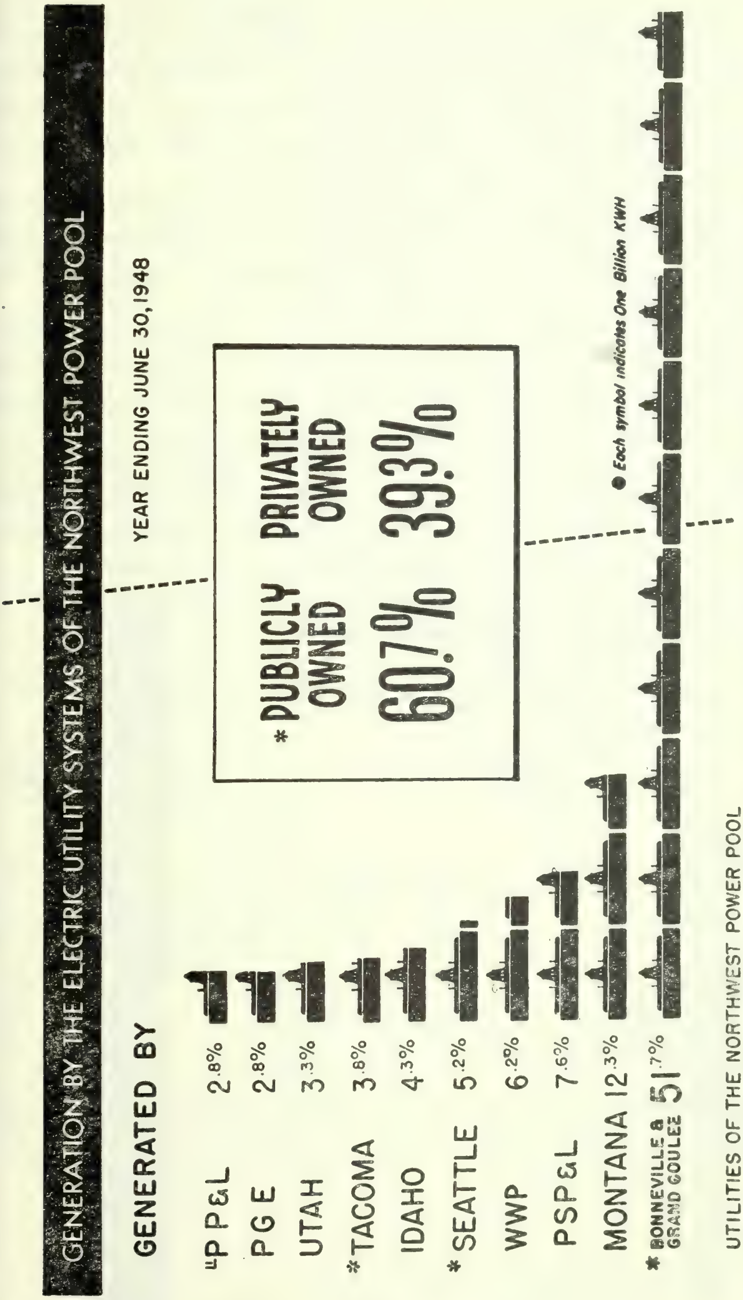
A further serious policy problem loomed at the year's end as a result of the continuing rise in construction costs. Cost increases of as much as 30 percent developed within the period between the date the Administration's estimates were submitted to the Bureau of the Budget in the autumn and the time bids were called for the expenditure of allowances approved by the Congress during the following summer.

An even more serious potential appeared in the tremendous increase in cost estimates for reclamation works, which are subsidized from power operations.

At the close of the year serious study was being given by both the Bonneville Administration and the Bureau of Reclamation as to probable effects of the construction cost increases on the basic wholesale power rate. To date, revenues from power operations exceed the expenses and pay-out requirements as constituted under present laws. Whether or not present rates will continue to exceed, or meet, requirements depends upon future costs of operations and construction, and the extent to which power operations must subsidize the increased irrigation costs of multiple-purpose projects.

SUMMARY OF RECOMMENDATIONS

The impact of these major problems, in the opinion of the Department, calls for positive action by the Congress and the Executive Branch in the following particulars:



GENERATION BY THE ELECTRIC UTILITY SYSTEMS OF THE NORTHWEST POWER POOL

YEAR ENDING JUNE 30, 1948

UTILITIES OF THE NORTHWEST POWER POOL

Pacific Power and Light Co., Portland General Electric Co., Utah Power & Light Co., City of Tacoma, Idaho Power Co., City of Seattle Washington Water Power—Pacific Power & Light Co., Montana Power Co. and the Bonneville Power Administration.

ᴸNorthwestern Electric Co. system merged with Pacific Power & Light Co. July 1, 1947

1. A policy of expediting the Federal generation program in the Pacific Northwest, with particular reference to authorized projects such as the Hungry Horse Dam of the Bureau of Reclamation, the War Department projects authorized on the Lower Snake, Foster Creek (Chief Joseph) Dam on the Columbia and Detroit Dam on the Santiam River in accordance with recommendations of the National Security Resources Board, the Columbia Basin Inter-Agency Commission, and the Army-Navy Munitions Boards.

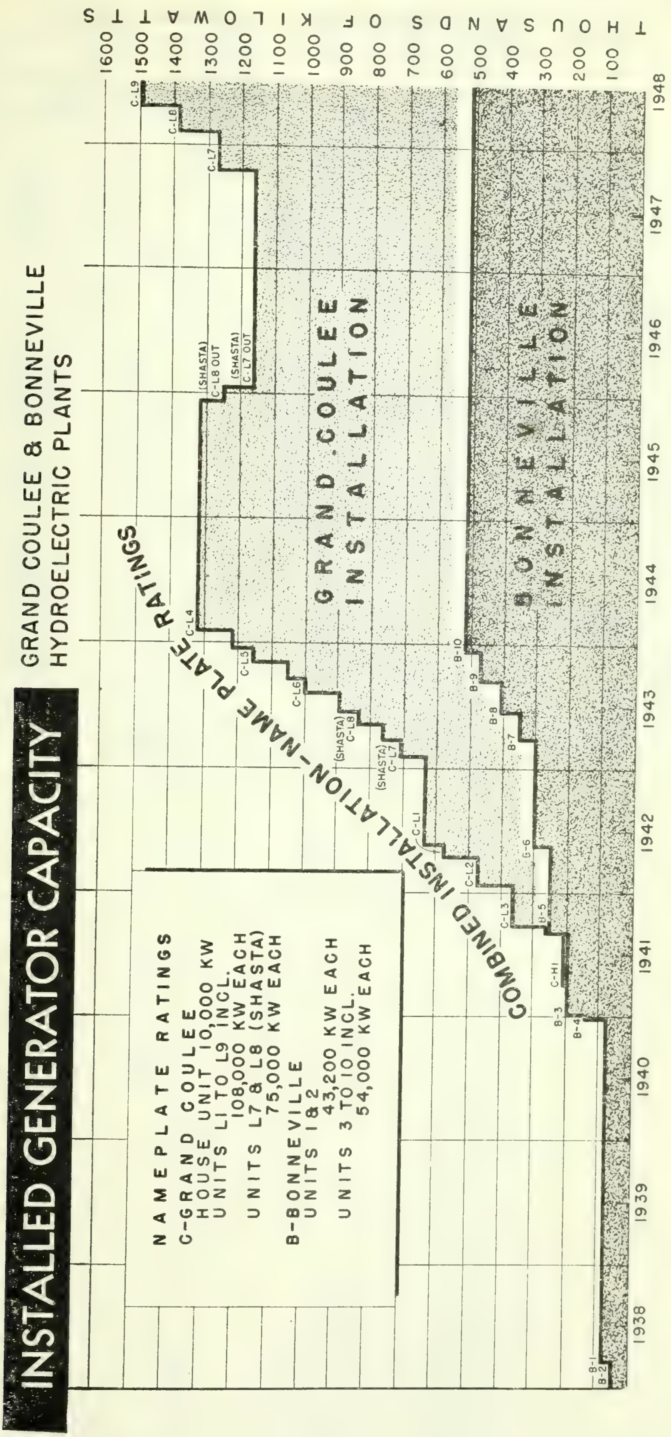
2. Early revision by the Congress of Federal fiscal policies controlling reimbursable public works with a view toward establishing a more flexible and efficient operation without a weakening of controls by the Federal legislature.

3. An accelerated program of major system extensions on the Federal transmission grid in the Columbia Basin, for the purpose of improving the efficiency and for the relief of the growing instability of the grid system due to overload and lack of reserve transmission capacity. Such extensions cannot well be undertaken by private enterprise utilities, yet will add immeasurably to the effectiveness of Northwest Power Pool operations and will serve as added protection to the national power supply in event of a major emergency.

4. Approval by the Congress of a policy of preventive maintenance on the Columbia River transmission system.

TABLE 5.—*Actual generation by the electric utility systems of the Northwest power pool, fiscal year 1948*

Utilities	Billions of kilowatt-hours	Percent of total generation
Publicly owned:		
Bonneville Power Administration	10.9	51.7
Seattle City light system	1.1	5.2
Tacoma City light system	.8	3.8
Total publicly owned	12.8	60.7
Privately owned:		
Puget Sound Power & Light Co	1.6	7.6
Washington Water Power Co	1.3	6.2
Pacific Power & Light Co	.6	2.8
Portland General Electric Co	.6	2.8
Montana Power Co	2.6	12.3
Utah Power & Light Co	.7	3.3
Idaho Power Co	.9	4.3
Total privately owned	8.3	39.3
Total Northwest power pool	21.1	100.0


INSTALLED GENERATOR CAPACITY

GRAND COULEE & BONNEVILLE HYDROELECTRIC PLANTS

TABLE 6.—*Proposed improvements of non-Federal utilities*

System and plant	Type	Unit No.	Name plate ratings, kilowatts	Year scheduled for installation
Pacific Power & Light Co., Merwin	Hydro	2	45,000	1949
California Oregon Power Co., Toketee Falls	do	1, 2, 3	40,000	1949
Seattle City Light:				
Gorge	do	4	60,000	1951
Ross	do	1	90,000	1952
Do	do	2, 3, 4	270,000	1953
Ross storage:				
900,000 acre-feet (total)				1949
1,200,000 acre-feet (total)				1951
1,400,000 acre-feet (total)				1952
Tacoma City light:				
Mossy Rock	Hydro	1, 2	150,000	1951
Do	do	3	75,000	1952
Mayfield	do	1, 2	80,000	1951
Do	do	3	40,000	1952
Puget Sound Power & Light Co., Rock Island [1]	do	5, 6, 7	60,000	1952
		8, 9, 10	60,000	1953
City of Eugene:				
Leaburg	do	2	7,500	1949
Walterville	do	4	8,000	1950
Eugene	Steam	3	13,000	1949
Montana Power Co., Kerr	Hydro	2	56,000	1949
Idaho Power Co.:				
Upper Malad	do		7,200	1948
Lower Malad	do		8,500	1948
Lower Salmon	do		52,800	1949
Bliss	do	1, 2, 3	69,000	1950
		4	23,000	1951
Utah Power & Light Co.:				
Orem	Steam	2	40,000	1950
New plant	do	1	60,000	1951
Do	do	1	60,000	1953
Total non-Federal additions			1,375,000	

[1] Additional units shown for Rock Island are possible but not definitely planned.

TABLE 7.—*Revenues by class of customers through fiscal year 1948*

Class of customers	1943 and prior	1944	1945	1946	1947	1948	Total to June 30, 1948	1948 percentage (dollar revenue)
Industry:								
Aluminum	$12, 360, 698	$11, 989, 735	$11, 838, 156	$7, 987, 226	$9, 045, 540	$10, 453, 425	$63, 674, 780	42. 64
Other industry [1]	1, 735, 758	3, 449, 736	4, 171, 469	3, 108, 749	1, 836, 349	1, 915, 884	16, 217, 945	7. 82
Publicly owned utilities	1, 773, 892	1, 994, 750	2, 141, 635	1, 711, 822	2, 778, 765	4, 318, 120	14, 718, 984	17. 61
Privately owned utilities	3, 751, 490	3, 401, 042	4, 752, 021	5, 209, 344	6, 127, 669	7, 633, 051	30, 874, 617	31. 14
Other electric revenue	69, 458	60, 665	86, 737	[2] 1, 867, 144	[3] 2, 102, 606	193, 230	4, 379, 840	. 79
Total operating revenue	19, 691, 296	20, 895, 928	22, 990, 018	19, 884, 285	21, 890, 929	24, 513, 710	[4] 129, 866, 166	100. 00

[1] This includes military establishments.

[2] This includes $1,789,443 of contract cancellations applicable to fiscal year 1946. (The total of $3,802,415 was apportioned over a period of 12 months.)

[3] This includes $2,012,972 of contract cancellations applicable to fiscal year 1947. (The total of $3,802,415 was apportioned over a period of 12 months.)

[4] As of June 30, 1948, the Administration had collected and deposited in the United States Treasury power revenue receipts totaling $118,050,821 and general fund receipts of $4,838,752. Accounts receivable, accrued unbilled revenues, unbilled exchange power sales, miscellaneous adjustments and minor items account for the difference between total revenues and total receipts deposited by the Administration with the U. S. Treasury.

TABLE 8.—*General specifications—authorized and unauthorized projects*

	Location	Proposed installations	Nominal prime power	Pool elevation	Usable sturage	Average head	Purpose
AUTHORIZED PROJECTS		*Kilowatts* [1]	*Kilowatts* [2]	*Feet*	*Acre-feet*	*Feet*	
Hungry Horse	Montana	286, 000	206, 000	3, 559. 0	2, 980, 000	391	Storage, power and flood control.
Grand Coulee [3]	Washington	1, 944, 000	[4] 1, 335, 000	1, 288. 0	5, 212, 000	324	Irrigation, power, and navigation.
Chief Joseph (Foster Creek)	do	1, 280, 000	[4] 682, 000	937. 5		171	Power and irrigation.
McNary	Oregon	980, 000	[4] [5] 558, 000	340. 0		87	Navigation and power.
Ice Harbor	Washington	260, 000	[5] 181, 000	440. 0		93	Do.
Lower Monumental	do	240, 000	[5] 173, 000	533. 0		89	Do.
Little Goose	do	260, 000	[5] 186, 000	633. 0		96	Do.
Lower Granite	do	220, 000	[5] 151, 000	715. 0		77	Do.
Anderson Ranch	Idaho	27, 000	5, 000	4, 196. 0	440, 000	260	Irrigation and power.
Palisades	do	54, 000	23, 000	5, 620. 0	1, 277, 000	144	Irrigation, flood control and power.
Detroit	Oregon	100, 000	32, 000	1, 569. 0	340, 000	299	Flood control, navigation and power.
Big Cliff	do	16, 000	10, 000	1, 197. 0		81	Do.
Meridian [6]	do	115, 000	36, 000	929. 0	368, 000	228	Do.
Roza	Washington	10, 000	5, 000			140	Irrigation and power.
Chandler	do	12, 000	11, 000			118. 5	Do.
UNAUTHORIZED PROJECTS							
Hells Canyon	Idaho	850, 000	645, 000	2, 075. 0	3, 280, 000	459	Navigation, power and flood control.
Albeni Falls	do	42, 600	32, 000	2, 062. 5	1, 140, 000	24	Storage and power.
Hills Creek	Oregon	20, 000	13, 000	1, 510. 0	221, 000	204	Flood control, navigation, and power.
Dexter	do	15, 000	11, 000	695. 0		53	Do.
Garden Valley	Idaho	54, 000	41, 000	3, 240. 0	1, 250, 000	280	Irrigation and power.
Upper Scriver	do	30, 000	21, 000	4, 505. 0		390	Do.
Lower Scriver	do	90, 000	42, 000	4, 060. 0		770	Do.

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[1] Name plate ratings.

[2] Average capability during system storage control period.

[3] Nine of ultimate 18 units are now in operation and 6 units are being manufactured.

[4] Generation includes benefits from 2.98 million acre-feet of usable storage at Hungry Horse and 1.14 million acre-feet usable storage at Albeni Falls.

[5] Generation includes benefits from 3.28 million acre-feet of usable storage at Hells Canyon.

[6] Power facilities are not authorized.

Southwestern Power Administration

DOUGLAS G. WRIGHT, *Administrator*

WITH the return in the early part of fiscal year 1947 of the custody, operation, and maintenance of the Grand River Dam project on the Grand (Neosho) River in Oklahoma and the 154-kilovolt transmission line of the Ark-La Electric Cooperative, Inc., to their respective owners, the Southwestern Power Administration was free to devote all its efforts to the distribution and marketing of hydroelectric power and energy generated at multiple-purpose reservoir projects in its marketing area (the Southwest), under the control of the United States Corps of Engineers, as prescribed and authorized under section 5 of the Flood Control Act of 1944.

Under responsibility delegated by the Secretary of the Interior, the Southwestern Power Administration obtains its hydroelectric power from such projects in an area which includes all of the States of Arkansas and Louisiana and parts of the States of Oklahoma, Texas, Missouri, and Kansas. This area contains approximately 350,000 square miles and has about 12,000,000 inhabitants.

During the latter part of the fiscal year 1947 and all of the fiscal year 1948 activities were concentrated on the construction program of transmission lines and appurtenances authorized in the 1947 and 1948 appropriations for this Administration. In the same period the Southwestern Power Administration, under section 5 of the Flood Control Act of 1944, continued to market hydroelectric power and energy generated at the Norfork Dam in Arkansas and the Denison Dam in Oklahoma-Texas.

Norfork Dam Project

The Norfork Dam project, constructed and operated by the United States Corps of Engineers, is located on the North Fork of the White River in Arkansas. It was designed for an ultimate installation of four 35,000-kilowatt generating units. Commercial operation of the first unit commenced on March 6, 1945. A second unit is now being installed. Although this second unit is expected to be ready for service during the second quarter of the 1949 calendar year, additional plant capacity will not be available until receipt and installation of the transformers which are scheduled for delivery in January of 1950. During the interim period, however, this unit may be used as a spare to the present unit.

In lieu of Government transmission facilities the power generated at this project was sold to the local private utility under a temporary contract which has been renewed from time to time. Revenue from the sale of this energy during the fiscal year 1948 amounted to $727,116.72, all of which was deposited with the United States Treasury. Contracts were executed with the Sho-Me Power Corp., a transmission cooperative, and the city of West Plains, a municipality, under which power and energy will be furnished them from the project as soon as transformers and transmission lines are available for use.

Denison Dam Project

This project located on the Red River and the Texas-Oklahoma border near Denison, Tex., also constructed and operated by the United States Corps of Engineers, commenced operation March 5, 1945, with one 35,000-kilowatt generating unit. It was designed for an ultimate installation of five 35,000-kilowatt generating units. The second unit is now being installed. It is anticipated that this second unit will be ready for commercial operation in December 1949.

Until the fiscal year 1948, lack of Government transmission facilities and any agreement with the private utilities to use their facilities, forced the Southwestern Power Administration to sell the power and energy generated at this project to the two nearby private utilities on temporary sales contracts. In the last few months of the fiscal year 1947, a unique type of contract was executed between Southwestern Power Administration and the Texas Power & Light Co. for the sale and disposition of a portion of the power and energy generated at the Denison Dam. Under this contract the Texas Power & Light Co. delivers power and energy for the Government to the other customers of the Government in the State of Texas and the Government, the private utility and the customers of both systems share in the benefits derived from the coordinated facilities. By the end of the fiscal year 1948 electric energy generated at the Denison Dam was being sold to two private utilities and five rural electric cooperatives. Revenues from these sales for the fiscal year were $790,072.47, which amount was deposited in the United States Treasury.

Construction

Under the 1947–48 construction appropriation of $7,500,000, contracts were executed for the construction of approximately 400 miles of 154/132-kilovolt transmission line connecting the Norfork and Denison Dam projects, 130 miles of 66-kilovolt feeder lines and a 154/143-kilovolt substation located near Weleetka, Okla.

The foregoing construction was divided into 11 separate contracts and awarded to 8 different contracting firms. Completion is expected by the end of the calendar year 1949.

The United States Corps of Engineers have under construction in the territory of this Administration seven multiple-purpose reservoir projects, and six other projects have been authorized for construction when funds are made available by Congress.

With the second units being installed at the Norfork and Denison projects and one unit of 17,000 kilowatts at the Narrows project now under construction, it is anticipated there will be 87,000 kilowatts additional capacity available by 1950 and completion of new projects will increase the total to 673,700 kilowatts in 1953.

Congress did not provide the Southwestern Power Administration with any new construction funds for fiscal year 1948 but reappropriated the unobligated balance of the 1947 appropriation for the construction of the Weleetka substation and for expenses incident to the administration, engineering, and supervision of contracts executed during the previous year.

The Southwestern Power Administration has received many requests from rural electric cooperatives and public bodies to purchase power and energy but the ability to serve these loads will depend upon several factors—completion of additional capacity by the United States Corps of Engineers, the success of negotiations with the private companies to use their facilities, Congressional appropriation of funds for Southwestern Power Administration to construct transmission lines and substations, or the construction of such latter facilities by rural electric cooperatives and public bodies.

Marketing

The marketing of surplus power and energy generated at the Norfork and Denison Dam projects played a very important role during the fiscal year 1948. Through the medium of the unique type of contract with Texas Power & Light, previously mentioned, it was possible to serve a number of rural electric cooperatives in Texas from the Texas Power & Light transmission lines without the necessity of this Administration constructing any facilities in that State. Six contracts were consummated with cooperatives in Texas of which five are receiving electric service and service on the other will start September 1, 1948.

Several contracts were executed with rural electric cooperatives in other parts of the territory served by Southwestern Power Administration under the terms of which service will be initiated as soon as the necessary facilities for generation can be constructed by the United States Corps of Engineers and this Administration can construct or obtain the necessary transmission facilities.

Negotiations with the private companies (other than Texas Power & Light Co.) in the area were carried on during the fiscal year 1948. On several occasions it appeared that further attempts to work out an equitable contract between these companies and the Federal Government might be of no avail. Recent developments, however, indicate a more optimistic trend.

Cost Allocation Studies

Studies concerning cost allocation problems on multiple-purpose dam projects in the area were continued during the fiscal year 1948. Various conferences were held with the district and division offices of the United States Corps of Engineers and the Federal Power Commission. These studies have centered particularly around the Denison and Norfork Dam projects. While it has not yet been possible to work out a procedure satisfactory to all interested agencies, it is believed that a groundwork is being laid which will be helpful and tend to simplify procedures to be adopted in the future.

Looking Forward

Completion of the construction program carried over from the fiscal year 1948 will be one of the main activities of the new fiscal year. This consists of approximately 400 miles of 154/132 kilovolt transmission line and substation connecting the Norfork and Denison Dam projects and 130 miles of 66-kilovolt feeder lines in Arkansas, Missouri, and Oklahoma. As various contracts of this program are completed, field organizations should be established with the necessary equipment and tools to operate and maintain the completed facilities. No provision for this item, however, was made in the appropriation for the fiscal year 1949.

Coincident with the construction programs of Southwestern Power Administration for transmission facilities and the United States Corps of Engineers for additional capacity in the area, and with the negotiations with the private utilities for the integration of facilities, the Southwestern Power Administration is executing contracts with rural electric cooperatives and municipalities to supply them hydroelectric power and energy to the limits possible without such integration with the fuel burning generating plants of private utilities.

To obtain the maximum capability from hydroelectric generating projects in the area, they must be integrated with fuel-burning generating plants. This can be accomplished by (1) interchange contracts with private utilities, cooperatives, public bodies, or industrial establishments having fuel-burning generating equipment, (2) Federal construction of fuel-burning generating plants, (3) Federal purchase of electric energy generated by others, and (4) Federal sale of all its hydroelectric energy to the private utilities or others having fuel-burning generating capacity with which it can be integrated.

The first method would be satisfactory and beneficial to the Government, the companies, and the customers of both systems.

Whether the Government obtains fuel-burning capacity by construction or by contract, it will be necessary to interconnect the generating facilities of each new hydroelectric project as it nears completion. This will require the construction of additional transmission facilities, unless interchange and integration contracts can be consummated to provide for the use of privately owned transmission facilities by the Government where such facilities are available. Such arrangements would provide for the most economic development of the country's hydroelectric resources to the maximum benefit of all the people.

Bureau of Mines

JAMES BOYD, *Director*

ACHIEVING maximum efficiency, safety, and conservation in extracting, preparing, and utilizing the Nation's mineral resources was the ultimate aim of every activity of the Bureau of Mines last year. The goal itself was not new. The Bureau had been striving toward it since 1910, but the unprecedented drain placed on the country's reserves by the needs of postwar reconstruction, when added to the depletion demanded by the war itself, had given it fresh urgency.

Depletion of rich ores was not novel in American history. The whole record of this country's minerals industries had been one of producing better and better products from leaner and leaner ores. The extent of the depletion, however, not only of the richer ores but of mineral fuels as well, was unprecedented. Together with the seemingly insatiable demands of an expanding domestic economy and of war-ravaged lands to whose rebuilding the United States was pledged, it gave added significance to the Bureau's work.

On many fronts that work went on, part of the endless struggle to maintain and strengthen the minerals leadership vital to this Nation's prosperity and power. In laboratory and pilot plant, in office and mine, in mill and quarry, Bureau staff members wrestled with problems nearly always complex, and sometimes intangible as well. Even their apparent failures, by narrowing the area of search for hidden minerals or by showing how not to develop a difficult technical process, constituted progress.

Out of 30 exploration projects carried out in quest of ore bodies that could be drawn upon in an emergency, 11 provided bases for important estimates of reserves of strategic minerals. To learn still more about the Nation's resources, the Bureau established two more "core libraries," where drill cores taken during governmental and private investigation projects can be stored along with geologic and mine maps, core-drill data, and other information, for future reference after serving their immediate purpose.

Mining techniques were studied, and the information obtained was made available to the industry. Typical of the Bureau's efforts were investigations to discover or devise an economical and effective way to drill and blast taconite, an extremely hard, low-grade iron ore of which the Lake Superior region has enormous reserves. Physical science was applied further to mining problems with good results;

equations worked out by Bureau physicists were confirmed by tests in the experimental oil-shale mine at Rifle, Colo., and there, too, an instrument they devised to measure roof sag proved its worth.

In the metallurgical field, the Bureau advanced farther toward bringing about effective and economic utilization of the Nation's reserves of metallic and nonmetallic minerals. It followed four main lines of approach: (1) Developing improved methods for beneficiating and processing low-grade ores; (2) developing new and improved mineral products; (3) developing substitutes for metals and minerals in short supply; and (4) recovering byproducts and utilizing industrial wastes.

To help maintain this Nation's leadership in steel production, the Bureau made progress toward the ultimate utilization of low-grade iron ores. It advanced in separating the iron from titaniferous magnetite and recovering the titanium as a byproduct. Laboratory and pilot-plant studies on sponge-iron production continued on a limited basis, and the Bureau continued to meet a growing demand for high-purity cobalt, manganese, and chromium which it had produced on a limited scale from electrolytic processes developed in its own laboratories and pilot plants.

Recovery of lead, zinc, and copper from marginal and submarginal ores was studied intensively, and processes were developed further for producing aluminum from materials other than high-grade bauxite. In its quest for substitutes for metals in short supply and in seeking maximum utilization of domestic ores, the Bureau expanded its investigation into the production of zirconium and titanium metals. Pilot-plant production of each of these unique metals was increased, and considerable testing was done on their amenability to forging, cold-rolling, casting, extrusion, and other treatment. Investigations and studies were made on alloys of titanium and zirconium, and on improved magnesium alloys. Studies of methods of beneficiating and processing nonmetallic minerals brought results promising to benefit the construction and glass industries, and progress was made in the search for synthetic substitutes for sheet mica, essential to the electrical industry and now mostly imported.

Efforts to assure ample supplies of fuels were spurred by shortages and by growing concern over the adequacy of reserves, not only of petroleum and natural gas, but also of special-purpose coals. While developing methods of upgrading low-grade coals for use, alone or in blends, to produce metallurgical coke, and delineating new reserves of coking coal, the Bureau sought ways of making greater use of vast deposits of lignite and subbituminous coal. The problem of storing lignite in such a way that it will not take fire spontaneously appeared solved, or nearly so, and in a pilot plant this lowest-ranking coal was converted into gas suitable for reducing iron ore, or, after further treatment, making synthetic liquid fuels. Under study were methods of drying and preparing subbituminous coal for safe and economical shipment.

Other work on coal ranged from studies of the effect of mechanized mining on the percentage recovered, and the development of mechanical equipment suitable for use in steeply pitching anthracite beds, to search for effective methods for recovering and utilizing fine coal now lost in washing. The Bureau acquired a site for the Anthracite Research Laboratory at Schuylkill Haven, Pa., for which the Congress had appropriated $450,000 and the Public Buildings Administration designed the structure. A site also was selected at Grand Forks, N. Dak., for a lignite research laboratory authorized late in the year.

Studies on production of synthetic liquid fuels from coal and oil shale made notable progress. A coal-to-oil laboratory was dedicated at Bruceton, Pa.; and at Laramie, Wyo., an oil-shale research and development laboratory was completed and occupied. That oil shale can be mined efficiently at low cost was demonstrated in the experimental mine at Rifle, Colo., and the feasibility of extracting crude shale oil was proved at a pilot plant nearby. A refinery was due to go into operation at Rifle during the next fiscal year. Two demonstration plants to produce liquid fuels from coal by different processes were under construction at Louisiana, Mo., one scheduled for completion during 1948 and the other during 1949.

To increase reserves of petroleum, the Bureau completed laboratory research on the recovery of oil from bituminous California sandstones. To make it possible to recover more of the oil in the ground, a fundamental study on the surface forces in natural petroleum reservoirs was begun. Studies also were conducted on metals that would resist corrosion in gas-condensate wells, and helium of 99.8 percent purity was produced on a large scale for the first time.

Conservation of human life and limb in the minerals industries was, as ever, a major concern of the Bureau, which strove to promote it through education, research, and coal-mine inspections. Because local legislation and disciplinary action have not proved to be fully effective in reducing accidents unless both supervisors and workmen were convinced that safety is an important part of their work, the Bureau's educational program was intensified. Training in the broad principles of coal-mine safety was made available to supervisory officials for the first time. A special course was instituted to familiarize coal-mine safety committeemen with accepted safety standards so that they could cooperate more effectively with management in preventing accidents. First-aid, mine rescue, accident-prevention, and other established training was continued on a large scale. The Bureau maintained close contact with the Joseph A. Holmes Safety Association, presented safety awards to plants and individuals, and encouraged first-aid and mine rescue contests, revived in many areas after having been suspended during the war.

Activities designed to promote safety and health in mines and plants covered a wide range. Studies of ways to reduce the danger of rock falls, which cause about half the fatalities in mines, led to the introduction into coal mines of an improved version of a type of roof support that had proved effective in some metal mines. Electrical equipment and its component parts were tested for permissibility for safe use in gassy coal mines, and certificates of approval were issued for those complete units and explosion-proof parts that met the exacting Bureau standards. Studies showed that free silica, one of the most injurious of dusts, settles more rapidly than other constituents of air-borne dust. Thousands of dust and air samples were analyzed for explosive or harmful ingredients, and the explosibility of many industrial dusts was determined and recommendations were made for reducing hazards. Respiratory protective devices were subjected to "permissibility" tests, and those meeting Bureau standards were approved.

Nearly 4,700 coal-mine inspections were completed under the Coal-Mine Inspection and Investigation Act of 1941, and the mine operators, mine workers' organizations, and the public were informed of the results of the investigations. Although the Bureau has no enforcement powers, reinspections showed that thousands of the inspectors' recommendations had been followed, notably for improved ventilation and rock dusting. Partly, this could be attributed to the cumulative effect of the safety educational programs of the State and Federal Governments and partly to acceptance, in the current wage agreements between operators and employees, of the Federal Mine Safety Code and the Federal Safety Standards for Anthracite Mines.

Under Public Law 328, three of four reports were submitted to give the Congress a quarterly picture of safety conditions in bituminous-coal and lignite mines, and of progress in their improvement; the final report was to be submitted as soon as data could be assembled for the last quarter of the fiscal year.

The Bureau conducted much economic research and prepared numerous studies for officials and agencies dealing with problems of foreign relief and rehabilitation, minerals procurement, technical and scientific cooperation with other governments, and national security. In a year characterized by great activity in those fields in both the legislative and executive branches of the Government, demands for detailed economic and statistical data were received continually from congressional committees, individual Members of Congress, the Economic Cooperation Administration, the National Security Resources Board, and other administrative agencies. In addition, the Bureau strengthened its periodic reports on all phases of the minerals industries, notably those dealing with metals and fuels, and it revamped its injury statistics to meet current demands. During the year, it initiated a monthly series of reports on all coal-mine injuries and employment.

Because technologic, scientific, and economic research is of limited value until its results become known to the industry and others able to profit by them, the Bureau published a large number of reports and papers during the year. However, to conserve available funds, the number of copies of each publication printed was held to a minimum. In addition, staff members addressed the meetings of many technical and scientific societies, and contributed numerous articles to the technical and trade press.

The Minerals Yearbook, long recognized as the outstanding authority on the Nation's mineral resources, was prepared, and individual chapters were published as preprints as promptly as possible. The complete volume, giving data on production, consumption, exports, and imports for all mineral commodities, was expected to be off the press soon after the close of the fiscal year. During the year, more people than ever before—12,000,000—saw films from the Bureau's loan library of educational motion pictures. These films depicting the uses and methods of producing various mineral commodities are sponsored by industrial concerns, which defray all expenses incidental to production and provide the Bureau with prints.

Of considerable assistance to the Bureau was the advice given it by two groups from industry—the National Bituminous Coal Council and the National Minerals Advisory Council—which were established during the fiscal year at the invitation of the Secretary of the Interior.

Summary of Activities

MINERAL DEVELOPMENT

Promoting the efficient and economical extraction and utilization of the Nation's metallic and nonmetallic mineral resources continued to be a main objective of the Bureau, which approached this goal on many fronts. Bureau engineers developed ore deposits holding promise of emergency value, though not now commercially attractive. They studied mining methods in search of improvements and experimented with new techniques. They increased and made more readily available the fund of knowledge of this country's mineral reserves.

Meanwhile Bureau metallurgists actively sought new and better methods of utilizing lean and complex ores. They improved techniques of producing the new light metals such as titanium and zirconium, began to experiment with alloys of these two metals, and continued to cooperate with industry in determining the uses for which these materials are best adapted. They made further progress in the development of lightweight aggregates suitable for building construction. Their studies ranged from ways of beneficiating low-grade iron ores, processing them, and preparing them for smelting to developing treatments that have made many marginal sand deposits available for the production of high-grade glass.

MINING ACTIVITIES

Strategic minerals program.—The investigation and development of domestic mineral deposits other than fuels was confined almost wholly to potential reserves of metals and minerals deemed essential to industrial security, particularly those known to be scarce and those classed as strategic. As in the past, the Bureau's activities were designed to obtain information believed important to the Nation's future security and welfare, and not to supplant the normal operations of the mining industry. The object was not to locate this year's or next year's ore supply but to block out a reserve for emergencies.

Thirty development projects were carried out, eleven of which provided a basis for ore-reserve estimates of some importance. Indicated were 410,000 tons of lead-zinc ore averaging about 2 percent lead and 2 percent zinc; 390,000 tons of copper ore averaging about 2 percent copper and 3 percent zinc; 670,000 tons of 45-percent iron ore; 34,000,000 tons of pyritiferous ore containing 33 percent iron, 19 percent sulfur, 0.4 percent copper, 1.5 percent zinc, and 0.4 percent lead; and about 1,000,000 tons of material containing 6 percent titania in the form of rutile.

The Bureau conducted investigations in two major zinc-lead districts to bring together the great mass of existing mine and exploration data as an aid to their future development. One of these surveys was completed, and it yielded an exhaustive, soundly based analysis of ore reserves in the Tri-State district of Missouri, Kansas, and Oklahoma.

Reports of Bureau mining engineers' field examinations of nearly 200 mineral deposits were added to the files during the year. These provide the basis for selecting development projects, expanding and correcting the Bureau's knowledge of domestic mineral resources, and helping keep up with developments in the mining industry.

As directed by the Congress, the Bureau began receiving the files of various wartime Government agencies that dealt with mining and mineral resources. Indexing this material, and preparing it for ready reference and study, was begun. Nonconfidential information of value to the industry is expected to be obtained from these files and made public.

Because critically significant information often has been lost when cores and cuttings were discarded after mineral deposits had been sampled by drilling, the Bureau has established core-storage warehouses at a number of field stations. Two more of these "core libraries" were built during the year, and many thousands of feet of samples were added. The Bureau encourages mining companies and other private investigators to place the cores resulting from their projects in these warehouses for permanent storage.

Mining-method studies.—Diamond drilling of blast holes, a recent technologic development in mining, was investigated extensively during the year, and as a result, details of methods and costs in several American mines were made available to the industry. Other published reports dealt with shaft sinking and with mining methods at various mines.

Experimental studies.—The Bureau applied the methods and techniques of physical science to mining problems with good results. Completion of two sets of model studies yielded equations for pillar stresses and for recovery versus loading relationships in room-and-pillar mining. These were tested and confirmed in the experimental oil-shale mine at Rifle, Colo., where an extensometer, designed for measuring roof subsidence, also proved its usefulness.

The applied physics program entered a new phase with studies of dynamic stresses in rock, such as are caused by blasting. A high-speed recording camera was designed and used for this project. Capable of measuring stress waves in the 20,000-cycle region, this device appears to be equally applicable to many engineering problems in mining and other fields. Physical characteristics pertinent to mining of about 100 more rock types were measured systematically, and data on as many others previously studied were awaiting publication.

In conjunction with the routine services of the Mount Weather, Va., experimental mine organization, which supplies diamond-drill bits and accessories to field projects, studies yielded definite information on the relative rate of wear, effectiveness, and over-all economy of various types of these costly supplies. The second report on an investigation of diamond drilling and diamond-bit testing, presenting conclusions of interest to all users of cast-set bits, was issued.

An investigation of the mining of a pegmatite deposit in Amelia County, Va., was begun during the year. It is expected to show whether the mica, beryl, tantalum minerals, and other valuable constituents of the pegmatite can be mined separately, or mined and separated effectively afterward, and to yield a reliable cost estimate. A similar project in Custer County, S. Dak., was begun and almost completed.

In the Lake Superior iron-ore region, the Bureau carried on a project to determine or devise the most economical methods of drilling and blasting the low-grade ore called taconite. Great reserves of taconite in this area are depended upon to supplement the limited reserves of the type of ore now being mined. It is exceptionally hard, so that breaking it up presents a unique and difficult problem.

A number of technical developments in equipment for and methods of drill-sampling ore deposits were reported. These enabled the Bureau to sample successfully such deposits as the Florida titanium-bearing dune sands and the Alabama brown iron ore. Toward the end of the year, an experimental core-drilling project, conducted on behalf of the Geological Survey, gave good indications that the Idaho phosphate deposits also could be sampled accurately.

Missouri River Basin studies.—Bureau mining engineers prepared 11 reports on mineral resources and their dependent industries, present or potential, in the Missouri River Basin. This work was done with specially designated Bureau of Reclamation funds, and the reports were made available to that and other Government agencies concerned with the development of the Basin.

METALLURGICAL ACTIVITIES

Ferrous metals and their alloys.—To enable this Nation to keep its leadership in steel production despite heavy depletion of high-grade iron ore, the Bureau made an intensive study of methods of utilizing lower-grade iron-ore deposits. Its search for methods of beneficiating, processing, and preparing for smelting the lower grades of ore from the Lake Superior region, the Birmingham, Ala., district, and the Pacific Northwest resulted in considerable progress. Treatment of titaniferous magnetites to separate the iron and recover the titanium as a byproduct reached a point where semi-pilot-plant work was justified. Laboratory and pilot-plant investigations on sponge-iron production under various conditions were continued as far as available funds allowed. Investigations on the manufacture of steel and ferroalloys from materials found in the Pacific Northwest were continued with a view to utilizing the chromium and nickel in some of these ores. Further studies in the electrolytic production of cobalt, manganese, and chromium from domestic sources resulted in substantial progress. When made by Bureau-developed electrolytic methods, these metals have a purity that makes them more effective for some purposes, and they continued in growing demand.

Nonferrous metals.—Unprecedented consumption during and since World War II so depleted known ore reserves of lead, zinc, and copper that every effort was being made to utilize marginal and submarginal ores. The Bureau's Albany, Oreg., Boulder City, Nev., and Tucson, Ariz., stations studied the problem of recovering these metals from oxidized, low-grade deposits. Investigations of certain smelting problems by the Rolla, Mo., station in cooperation with a leading zinc and lead company considerably advanced knowledge of losses in the extractive metallurgy of these metals.

New and light metals.—Depletion of known reserves of high-grade ferrous and nonferrous metal ores and the demand for strong, lightweight structural materials have greatly increased the importance of the light metals—aluminum, magnesium, and titanium. The potential reserves of raw materials from which these can be made are enormous and widely distributed, but the economic utilization of numerous marginal deposits depends largely upon development of new and improved methods of extraction.

Bureau investigations that led to the development of methods by which alumina-bearing materials other than high-grade bauxite can be processed under emergency conditions were continued. Further improvements were sought, as was the utilization of certain waste products discarded when bauxite is treated by the standard Bayer method. The presence of titanium and zirconium minerals in low-grade bauxite offers a possibility of utilizing material that otherwise cannot be handled economically.

Engineering studies at the Albany, Oreg., station revealed the practicability of recovering high-purity metallic magnesium by the electrothermic reduction of magnesia. Investigations on the development of improved magnesium alloys, conducted at the Rolla, Mo., station, have yielded some products that show exceptional strength and durability.

Pure metallic titanium and zirconium were produced on a pilot-plant scale for distribution to industrial concerns wishing to cooperate in determining the uses for which these Bureau-developed metals are best adapted. As their importance in pure metallic form already had been fairly well demonstrated, studies were made on their alloys.

At the College Park, Md., station, the Bureau conducted investigations on treating light-metal scrap to recover aluminum in a form suitable for reuse. The problem is not simple, owing to the variable composition of the vast quantities of such scrap produced yearly, but much progress has been made in separating the constituents of these alloys by vacuum distillation and filtration.

Rare and precious metals.—Restrictions on gold mining having been lifted, the Bureau intensified research on the recovery of gold and silver from low-grade and complex ores, and from old tailings, fumes, and dilute solutions. Absorption of gold by activated carbon, leaching out of the gold obtained, and its electrolytic deposition from the alkaline sulfide solution opened up promising possibilities. The work on precious metals was integrated closely with the extraction of other metals from the ores treated.

Gallium and thallium are two so-called rare or semirare metals of growing military and industrial importance that the Bureau studied intensively. Investigations covered possible sources of these metals and methods of recovering them. The practicability of separating these elements from industrial wastes in which they are often concentrated was studied at the Rolla, Mo., and Salt Lake City, Utah, stations. A technical report and complete bibliography on thallium was prepared.

Nonmetallic minerals and their products.—The broadening field of the Bureau's work on nonmetallics, or industrial minerals, included structural materials, insulating products, ceramics, refractories, abrasives, fertilizer materials, and pigments.

Owing to the housing shortage since World War II and rising costs of construction labor and materials, the Bureau gave particular attention to developing strong, lightweight concrete aggregates. In cooperation with the United States Department of Commerce and other Government and industrial agencies, great progress was made in producing lightweight products from expanded perlite (a volcanic rock), certain clays, and waste materials from the phosphate, coal, and slate industries. A number of these mineral products and residues swell naturally when heated under controlled conditions, and others may be caused to expand by adding small quantities of other minerals or cheap reagents.

Since the lack of adequate domestic deposits of sheet mica—essential to the electrical industry—is a matter of national concern, the Bureau undertook investigations aimed at producing synthetic substitutes. Products with much the same composition and properties as phlogopite mica were obtained in small crystals at the Norris, Tenn., station, and studies were undertaken of the conditions under which larger and more satisfactory sheets or crystals can be produced.

The rigid specifications for sand suitable for making the better grades of glass, which is being used increasingly for a multitude of purposes, led the Bureau to study ways of removing small quantities of impurities. Beneficiation methods were developed that gave many marginal sand deposits economic value.

Ceramic products and improved methods of manufacturing them from domestic minerals were investigated at the Norris, Tenn., station. The advantages of electrically fired kilns for preparing whiteware and other ceramics have been demonstrated.

Considerable research was done at the Rolla, Mo., station on testing mineral deposits and blending various raw materials to make them suitable for the manufacture of mineral wool, one of the most effective and safest products for home and office insulation. Techniques for producing mineral wool and testing the quality and effectiveness of fibers have been developed.

The South Dakota pegmatites offer a fruitful field for research, as they contain a wide variety of minerals, such as mica, feldspar, spodumene, and beryl, only one or two of which have been recovered economically thus far. At the Minneapolis, Minn., station, the Bureau began investigations aimed at extracting some of the rarer pegmatite minerals as well as those present in larger quantities.

Production of heavy-duty refractories that will stand up under even more severe conditions was an important problem at the Norris, Tenn., station. Firebrick made of sillimanite, of which South Carolina and Georgia have large deposits, have shown excellent resistance to load at high temperatures, and they withstand the corrosive action of molten alkaline slags and glasses. Because of its outstanding work on refractories, this station was assigned the task of determining the suitability of certain foreign sources of kyanite for stock piling.

Phosphate rock, a basic raw material for fertilizers, received special attention during the year. The practicability of developing more extensively the huge phosphate deposits in Utah, Idaho, Wyoming, and Montana depends upon new and improved beneficiation methods, and the recovery of salable byproducts. Besides conducting ore-dressing investigations designed to raise the phosphate content of the lower-grade rock, the Bureau studied the feasibility of recovering vanadium from the phosphatic shales that can be treated by the electric furnace process for producing phosphorous and phosphoric acid. Economic studies were conducted in cooperation with the Bonneville Power Administration.

Fuels and Explosives

Growing concern for the Nation's fuel resources, and shortages caused by rising demands here and abroad, formed the background for the Bureau's program of fuel development and research. Designed to assure adequate supplies while promoting maximum safety and conservation, this work covered many phases of the exploration, extraction, processing, and utilization of coal, oil shale, petroleum, and natural gas—the four great sources of fuel energy.

During the fiscal year, diamond drilling added to the Nation's known reserves of coking coal, and progress was made in treating and blending lower grades of coal for making metallurgical coke. Advances were made in equipment and techniques for mining both bituminous coal and anthracite mechanically. Studies and tests pointed toward greater utilization of vast reserves of lignite and subbituminous coal. In laboratory and pilot plant, valuable data were obtained for producing synthetic liquid fuels from oil shale and coal. Important progress was achieved in developing more effective methods of recovering petroleum from partly depleted underground reservoirs. Helium, of which the Bureau is the sole producer, was made available in quantity at a degree of purity never before obtained except in relatively small volumes.

COAL AND COAL PRODUCTS

Coal mining and investigations.—The Bureau's studies of coal-mine mechanization continued, with emphasis on using mechanical equipment to extract pillars and the effect of adopting it on the percentage of coal recovered. Design of new machinery for use under difficult mining conditions progressed successfully. A shearing machine for cutting steeply pitching anthracite beds proved highly efficient. It was to be used in setting up a mechanical mining system for removing pillars 50 feet thick from an anthracite mine, with the possibility of safely and efficiently recovering 1,000,000 tons of coal during the project and many millions of tons from pillars in other mines. A scraper-shaker loading machine also was tested with promising results, and considerable progress was made in designing a vibrating-blade coal planer.

Investigations resulted in estimating reserves suitable for mechanical mining in Oregon's Coos Bay coal field at more than 13,500,000 tons, and in delineating additional reserves in the Matanuska Valley in Alaska. Diamond drilling of coking-coal deposits was done in Colorado and Maryland.

Coal preparation.—The Bureau adapted the cyclone coal washer to dewatering coal slurries. Its capacity is several hundred times that of conventional thickeners, and it can thicken slurries with a low solid content to a consistency of 60 to 65 percent solids.

Tests made as part of a broad examination of coking-coal supply problems indicated that conventional washing processes can render coal from some of the older Maryland beds suitable for use in coking blends with high-volatile coals. A Bureau-developed combination process for cleaning and dewatering fine coal was used at an Alabama mine with results pointing toward increased recovery of coking coal throughout the industry.

A study of the preparation characteristics of Peruvian anthracite disclosed extensive minable deposits constituting a possible source of supply for Pacific coast consumers. Investigation of the washing characteristics of an Oregon coal assured a fuel supply for a steam plant to relieve an electric power shortage at Eugene, Oreg.

Coking and gasification studies.—A new experimental coke oven designed to make possible a more complete evaluation of coking coal was put in service. Tests revealed that two West Virginia high-volatile coals, not commonly used, will yield metallurgical coke if carbonized in blends with low-volatile coal. Research on the complete gasification of coal showed that caking bituminous coals may be converted into gas of high heating value in Lurgi pressure generators after low-temperature carbonization.

Coal combustion.—Ways were demonstrated to reduce operating costs and increase the flexibility and availability of electric power plants, which in 1947 burned 86,000,000 tons of coal, most of it pulverized. Tools and techniques were developed to improve thermal efficiency and make it possible to burn a wide range of coals in pulverized-coal-fired furnaces. To clarify the results of many years of research on the properties of coal ash, the Bureau summarized available information. Essential to studies of the efficient combustion of coal, a method was developed for determining its reactivity with oxygen.

Research facilities and projects.—As authorized by the Congress, the Bureau obtained a site for the Anthracite Research Laboratory at Schuylkill Haven, Pa., and the Public Buildings Administration designed the structure. Late in the fiscal year, a new lignite research laboratory was authorized, and a site was selected at Grand Forks, N. Dak.

Carrying forward its investigation of a continuous process for gasification of lignite, the Bureau operated a pilot plant that produced 13,000,00 cubic feet of gas that can be used directly for reduction of iron ore, or, after a further step, for making synthetic liquid fuels, production of ammonia, and other industrial purposes. Lignite, normally subject to spontaneous combustion, was kept successfully for eight months in model storage piles aggregating several thousand tons. The problem of storing subbituminous coals having been solved previously, Bureau investigations progressed to pilot-plant studies of high-speed drying of low-rank coals, and to the development of equipment for continuous drying and burning of pulverized low-rank coal in small industrial furnaces as a substitute for fuel oil.

Services to Government.—Continuing its service to Federal agencies, the Bureau determined the type of fuel and fuel-burning equipment to be used at 13 new Veterans' Administration hospitals and the practicability of fuel substitutions at 16 other hospitals. Improvement continued in boiler-water conditioning for Federal plants, more than 2,000 of which were being served. Under Presidential directive, the Bureau passed on more than 300 proposed oil- or gas-burning installations. Twenty-eight cities received smoke-abatement advisory services. For various phases of the Bureau's program, including the inspection of Government coal purchases and the sampling of coal-mine dusts by Federal inspectors, more than 20,000 samples were analyzed.

Gas- and dust-explosion research.—In the continuing effort to reduce the risk of coal-mine explosions, many previously known methods were improved and new ones developed. The efficacy of various materials and methods for extinguishing coal-mine fires was investigated. Appropriate conditions for venting explosion pressures were demonstrated, as were methods of extinguishing explosions by controlling oxygen and by adding inert gases. The Bureau continued studies of the mechanism of ignition, propagation of flame, and flame stabilization and quenching, obtaining fundamental information useful in avoiding ignition of firedamp in coal mines. The flammability of explosive gases and vapors at very high and at low pressures was determined. Testing of 95 samples of dusts and powders brought the total number examined to more than 1,300 and provided additional data for use in preparing national and State safety codes.

SYNTHETIC LIQUID FUELS

With oil demand at a new peak and the need for supplemental sources swiftly approaching, the Congress in 1948 extended the synthetic liquid-fuels program for 3 years and authorized expenditure of an additional $30,000,000. The Bureau pushed forward in its campaign of research and development. One demonstration plant and all the laboratories were in full operation, investigating processes for converting two great mineral-fuel energy reserves—coal and oil shale—to liquid fuels.

Utilizing oil shale.—At Rifle, Colo., estimates of oil-shale mining costs were reduced impressively and the oil-shale demonstration plant's two retorts produced nearly 5,000 barrels of oil. Improved retorting processes were being developed, a demonstration refinery was under construction, and estimates of the western Colorado shale reserves were revised upward to some 200 billion barrels on the basis of 15 gallons per ton of shale. Core drilling and sampling to obtain a more accurate estimate were still incomplete.

Two shale-mining operations had been developed: A selective mine to supply the retorts with raw shale, and an underground quarry to determine commercial-scale production methods and costs. The underground quarry has demonstrated that oil shale can be mined mechanically in western Colorado for 70 cents a ton with a probable reduction to about 60 cents, compared with an average coal-mining cost of $3 a ton.

A third of the crude shale oil produced at Rifle was burned successfully as boiler fuel, sharpening the interest of west coast industry. About 6 percent was shipped to oil companies and other organizations for cooperative refining studies, and the rest was stored for use in the refinery, which was scheduled for completion in the fall of 1948. Under other cooperative agreements, raw shale was mined, crushed, and sent to private laboratories.

More efficient and less expensive retorting processes were under development in pilot plants. One batch-type unit, called the Royster retort, was operated, and a continuous unit, called the gas-flow retort, was fabricated and was to be put into service during the summer of

1948. Cooperative tests were planned on two continuous-type retorts developed by the Union Oil Co. of California and the Standard Oil Development Co.

At Laramie, Wyo., work done at the Oil-Shale Research and Development Laboratory yielded much basic information on the chemical and physical character of oil shales and shale oils, as well as engineering, thermal, and thermodynamic data necessary for the design and operation of retorts and refineries.

During the year, about 1,400 oil-shale samples were assayed. Most of them came from core-drill holes on Naval Oil-Shale Reserve No. 1 in western Colorado.

Liquid fuels from coal.—At Louisiana, Mo., two demonstration plants for converting coal to oil by different processes were under construction on the site of a Government-owned synthetic ammonia plant.

The first, a coal-hydrogenation (Bergius-process) plant with a capacity of 200 barrels daily, was scheduled for completion in the late summer of 1948. Full-scale operation to produce fuel oil and gasoline was anticipated later in the year. Western coals well-suited to the process were to be used at first, with coals from other sections to be tested later. Process refinements incorporated in the plant were expected to yield heat efficiencies 20 percent better than the Germans attained.

The second demonstration unit, a gas-synthesis (Fischer-Tropsch-process) unit with a capacity of 50 to 80 barrels daily, was to be completed in 1949. This plant was to employ a new-type coal-gasification unit in which synthesis gas can be made from noncoking coals in a one-step operation. It also was to incorporate a newly developed converter unit that can be enlarged to produce 1,000 barrels daily, compared with the 18-barrel-a-day capacity of the German converters. Offering good temperature control and high capacity, this internally cooled converter can produce a good grade of motor gasoline or an excellent Diesel oil, depending on the catalyst introduced. Oxygen for the gasification unit was to be extracted from the air by a Linde-Frankl plant brought from Germany.

Besides supervising construction, the engineering staff of the demonstration plants has made detailed cost estimates for commercial-size plants.

At Morgantown, W. Va., definite progress was made on processes for cheap production of synthesis gas (carbon monoxide and hydrogen), the major cost factor in synthetic fuels manufacture and the most important single research problem. A solution was being sought through (1) gasification of coal in place underground; (2) gasification of pulverized coal in superheated steam containing oxygen; and (3) gasification of powdered coal with oxygen and steam in a vortex reactor.

Encouraged by the results of an initial field test at Gorgas, Ala., the Bureau and the Alabama Power Co. jointly arranged to conduct a second and larger experiment on underground coal gasification during the summer of 1948.

At Bruceton, Pa., structures to house the main coal-to-oil laboratories and pilot plants were completed, occupied, and dedicated during the fiscal year. Improvements in both the hydrogenation and gas-synthesis methods of converting coal to oil were under development there. The internally cooled converter to be installed at the Louisiana, Mo., plant was developed, and it was shown that under certain conditions ordinary water gas may be used, with a saving of 20 percent in the cost of hydrogen used in the coal-hydrogenation process. Another process modification under study was the hydrogenation of dry coal, which would eliminate not only the paste making and handling equipment, but also the recycling of large quantities of oil. Extensive studies were in progress to find catalysts that will permit hydrogenation at low pressures, particularly for fuel oil.

PETROLEUM AND NATURAL GAS

As demands for petroleum and natural gas remained at record levels, the Bureau continued its comprehensive technical research designed to promote maximum recovery and most effective utilization of these exhaustible resources.

The Bureau completed engineering studies of reservoir conditions in the Lake Creek field, Montgomery County, and the Sheridan field, Colorado County, Tex., and reservoir-oil characteristics in the Rangeley field, Rio Blanco County, Colo. Changing characteristics of reservoir oil in the Lance Creek field, Niobrara County, Wyo., were investigated further, and study of the New Hope field, Franklin County, Tex., was continued.

Research on the phase relations of natural hydrocarbon mixtures (gas condensates) at temperatures as low as 100° below zero, Fahrenheit, yielded highly useful information for production and refining operations. In a study of metals for use in gas-condensate wells subject to corrosion, the relative resistance of 105 alloys to propionic and carbonic acids was determined, and steels containing 9 percent or more of chromium or nickel were found to be adequately resistant.

Increasing demand for liquid fuels led the Bureau to concentrate on more basic studies in its secondary-recovery work. It initiated a program of fundamental research on the nature of the surface forces in natural petroleum reservoirs. Preliminary study indicated that injecting large volumes of gas may be necessary for maximum recovery in the Appalachian region. Secondary recovery of oil by water flooding was studied in Texas fields, the Atlanta field, Columbia County, Ark., the Red River field, Tillman County, Okla., and the Boggs field, Roane County, W. Va.

Laboratory studies were completed on recovering oil from bituminous sandstones near San Luis Obispo, Calif., and they provided much fundamental information on a Bureau-developed, hot-water separation process. Other laboratory studies completed dealt with gravity drainage of oil from unconsolidated sands, the effect of air-drive secondary-recovery processes, and heating the formation to reduce the viscosity of the oil.

Significant advance was made in the study of Diesel fuels, including probably the most extensive analyses ever made of a series of such fuels; these showed types of hydrocarbons in terms of paraffins, naphthenes, aromatics, and, to a certain extent, unsaturated compounds. Controlled-pressure apparatus for analyzing crude oils by the Bureau's routine method was installed at the high-altitude Laramie, Wyo., experiment station. A method was developed for analyzing asphalts in terms of asphaltenes, resins, and oils. Under a cooperative agreement, samples of thiophene, ethyl sulfide, and methyl ethyl sulfide were purified and sent to the Bureau of Standards for distribution as standard samples.

HELIUM

The Bureau's Exell, Tex., Helium Plant produced 67,486,567 cubic feet of helium, of which 23.6 percent, or 15,916,747 cubic feet, was sold for medical and commercial use. This was 19.4 percent more than was sold for these purposes in fiscal year 1947. The purity of helium supplied to all users was increased from 98.2 to 99.8 percent, of particular commercial significance because some types of helium-shielded arc welding cannot be done successfully with gas of the lower purity.

The Bureau continued its search for fields suitable for production and conservation of helium. In addition, 21,501,420 cubic feet, the excess production from the Exell plant, was conserved by injection back into the Government's Cliffside field in Texas.

A small but well-planned research program was conducted in quest of new and better techniques for using helium in welding and metallurgy, developing more efficient extraction through study of high-pressure separation, developing equipment for cheaper transportation, and finding new uses for this inert gas, such as tracing the flow of oil and gas in natural underground reservoirs.

EXPLOSIVES TESTING AND RESEARCH

The Bureau conducted more than 1,600 tests on permissible explosives and blasting devices, special types of explosives, detonators, and hazardous chemicals. The list of permissible explosives was increased to 191 by adding 2 new products, a method was worked out for evaluating and standardizing the strength of detonators, and a vibrator-type, permissible, multiple-shot blasting unit was developed.

In the Bureau's fundamental explosives research program, new methods were discovered for measuring the rate of detonation of explosives and the temperature in detonation waves. Investigation of the explosibility of ammonium nitrate, which caused the Texas City, Tex., disaster, revealed that this material can be detonated by heat alone under certain conditions of confinement.

SAFETY AND HEALTH ACTIVITIES

Through education, investigations, and studies, and an expanded coal-mine inspection program, the Bureau continued to discharge the responsibility placed on it by the Congress 38 years ago for promoting safety and health in the minerals industries. While much still remained to be done, definite progress was made in combatting physical and psychological hazards in mines and plants.

Accident-prevention courses for coal-mine supervisory officials and special courses for coal-mine safety committeemen were inaugurated. First-aid, mine rescue, and other safety training was conducted for those engaged in all branches of the minerals industries. Assistance was given in recovery work after mine explosions and fires. Studies to reduce the danger of roof falls, the greatest single cause of fatal mine accidents, resulted in the development and adoption of new coal-mine timbering techniques. Knowledge of the explosion and health hazards of mine and plant dusts, and of ways of countering them, was advanced. Electrical equipment was tested for safety of operation in gassy coal mines, and emergency mine communications apparatus was developed and tested. More progress was made in the study of controlling flood waters that threaten life and property in the Pennsylvania anthracite regions. More coal-mine inspections were made than in any previous year, and an impressive number of improvements resulted from the Federal inspectors' recommendations, even though many of them went unheeded.

During the fiscal year, 4 major coal-mine disasters occurred, killing 49 men. Three were explosions, and the other was a "bump"—a sudden upheaval of the underground strata—that killed 6 men. Bureau personnel assisted in rescue and recovery operations at virtually all major disasters at coal and noncoal mines, and it is believed that their efforts enabled many mines to resume production sooner than would have been possible otherwise. Investigations were made of 32 explosions and mine fires, and of 76 miscellaneous accidents.

Safety education.—Eight mining engineers were engaged under a supplemental appropriation to conduct accident-prevention courses for coal-mine supervisory officials. The industry cooperated with the

Bureau in this undertaking; and between March 1, 1948, when the first class was organized, and the end of the fiscal year, a total of 600 mine officials were in training. Subjects covered included falls of roof and coal, handling and storage of explosives, use of electricity, ventilation, transportation, explosions and fires, miscellaneous accidents, and other hazards identified in the Federal Mine Safety Code and in the Federal Safety Standards for Anthracite Mines. Such training is not ordinarily available to mine officials, and the need for it had long been apparent. The coal-mining industry has an estimated 50,000 supervisory officials.

Another educational advance was the inauguration, in cooperation with the United Mine Workers, of a course for mine-safety committeemen. About 2,000 of the estimated 12,000 mine-safety committeemen in the United States completed this training, as did some 1,500 other miners. Its aim was to acquaint the committeemen with the code so that they could cooperate more effectively with management in improving safety and health conditions and practices.

The training of 30,848 employees of the minerals and allied industries in first-aid and mine rescue work brought the number of persons who have completed such courses since the establishment of the Bureau to 1,705,489. Moreover, 213 persons were trained as first-aid instructors, bringing the number of those qualified to teach the Bureau's first-aid program past 17,700. The 1948 figures include 2,435 mine workers instructed in mine rescue work and 13 persons who took the Bureau's advanced mine rescue course. During the year, 36 more mines and plants were awarded certificates showing that their entire personnel had been trained in first aid. The Bureau assisted in conducting 44 first-aid and mine rescue contests in 9 States.

Accident-prevention training for persons employed in the minerals industries was continued, with 787 workmen and officials completing the metal-mine accident-prevention course and 164 completing the coal-mine course. A safety instruction course was given to 4,862 coal miners, 863 persons were trained in the use of explosives, and 112 took the petroleum-gas safety course. A course for reduction plants and mills was being formulated.

The Bureau continued to maintain contact with local chapters and district councils of the Joseph A. Holmes Safety Association. The association gave safety awards to numerous plants, supervisors, and individuals in all branches of the minerals industries, presenting them at meetings where Bureau of Mines personnel participated.

Investigations and tests.—During the year, investigations were in progress to develop means of reducing accidents caused by falls of roof, which are responsible for half the fatalities in mines. In coal mines, the accident rate from this cause was improving, but in metal mines it was at a standstill. While striving to reduce the frequency of such accidents in metal mines, the Bureau did not overlook the need for still greater improvement in coal mines.

Petrographic examinations were made of thin sections of rock samples to determine whether this procedure would indicate where rock falls were likely, and the results, while inconclusive, indicated that this method might be helpful in roof control. Meanwhile, Bureau engineers improved upon a roof support used in metal mines and adapted it to coal mines. Essentially it consists of an I-beam held in place by steel rods secured in boreholes in the roof rock instead of by posts or legs. These supports were used successfully in a number of mines where Bureau personnel introduced them. Publications describing them were prepared for distribution to the coal-mining industry.

To evaluate potential hazards, the Bureau analyzed about 15,000 gas and dust samples collected in coal, metal, oil-shale, limestone, clay, salt, gypsum, sand, potash, and gilsonite mines and tunnels. Recommendations for measures to prevent explosions and exposure to harmful gases and dusts were based on the approximately 100,000 individual determinations made on these samples. The results also were utilized in controlling mine fires. In addition, information on dust-explosion hazards of many industrial products was gathered and given to the public and to manufacturers. Data were collected on the prevention and control of explosions of these products, and of fires caused by such explosions. Many of these data are used in the codes of fire-prevention associations. During the fiscal year, requests for information on explosive dusts were received from 29 States and countries.

X-ray diffraction and petrographic studies were made to determine the composition of a variety of dusts. A study of the comparative efficiency of the filter-paper sampler and the electric precipitator disclosed that the former was satisfactory for collecting zinc oxide fume and lead dust. The amount of free silica present in air-borne dust was found to decrease during settling, an important finding because free silica is one of the most injurious of dusts.

Laboratory studies were made on the performance characteristics of gas-indicating instruments and the causes of carbon monoxide formation and explosions in compressed-air systems. Information on mine and tunnel ventilation, mine air conditioning, and fluid flow was supplied to mine operators and others, and study of heat and moisture changes in the ventilating currents of hot, deep mines was continued.

In cooperation with the Navy Department, Bureau of Ships, tests were made to determine the nature and quantity of toxic gases freed in the burning or thermal decomposition of synthetic resins that might be used for insulation. Other work done for the Navy Department included tests to determine fire hazards associated with two types of aircraft fuel gages, explosion hazards associated with a "velocity power" type of cable cutter, durability of a carbon monoxide indicator under vibration and shock, and factors and characteristics required in designing intrinsically safe electrical circuits for fuel gages.

Inspection and testing resulted in the approval of 55 complete units of electrical equipment and 33 explosion-proof parts as permissible for use in gassy coal mines. In connection with this work, 1,508 explosion tests were made. In addition, four new approvals and numerous extensions of approval were granted for respiratory protective devices.

Emergency mine-communications apparatus for use in rescue operations was further developed. It was tested under varying conditions in anthracite and noncoal mines, and satisfactory communication was established over a distance of 2½ miles.

The Bureau also conducted investigations designed to determine the feasibility of Federal participation in construction projects or pumping operations in the Pennsylvania anthracite regions aimed at preventing disasters caused by flooding of mine workings, making it possible to mine large reserves of anthracite, and permitting the continuance of mining operations threatened with loss because of rising costs.

Water infiltration from flash floods, water-laden strata, and impounded mine water is the principal threat to the life of the anthracite industry. Factual information was being gathered on damage to property by subsidence owing to lack of backfilling in mines; the position and size of underground water pools in relation to active mine workings; the type and size of barrier pillars and mine dams in present workings and their effectiveness in withstanding the pressure of impounded water; the configuration and extent of the water-bearing deposits known as the Buried Valley of the Susquehanna River; and the infiltration of surface water from Leggitts and Leach Creeks into mine workings.

Coal-mine inspections.—Under congressional authority, the Bureau increased its force of coal-mine inspectors to 200 during the fiscal year. Inspections completed in accordance with the Coal Mine Inspection and Investigation Act of 1941 (Public Law 49, 77th Congress) totaled 4,661.

The Federal Mine Safety Code for Bituminous-Coal and Lignite Mines of the United States and the Federal Safety Standards for Anthracite Mines continued to be the criteria used by the Federal inspectors. The Code and the Safety Standards were recognized as authoritative in the contracts negotiated in 1947 between the United Mine Workers and the bituminous-coal and anthracite operators, respectively. The bituminous-coal operators and the union agreed to act promptly to correct Code violations found by the Federal inspectors, and in the anthracite industry both sides agreed to accept the Federal Safety Standards subject to the right of appeal to the Director of the Bureau of Mines upon petition from either the operator or the union.

Records of some of the major improvements reported by the Federal coal-mine inspectors indicate that during the fiscal year, roof-fall hazards were reduced by better timbering in 987 mines; important ventilation improvements were made in 1,330 mines; permissible explosives replaced dangerous black blasting powder in 160 mines; 349 mines were rock-dusted for the first time, and 824 partly rock-dusted mines were brought up to standard; smoking was discontinued in 215 mines; permissible electric cap lamps replaced open lights in 168 mines; and preshift examinations for gas and other hazards were instituted in 541 mines.

In accordance with Public Law 328, approved on August 4, 1947, three reports were made to give the Congress a quarterly picture of safety conditions in underground bituminous-coal and lignite mines, and of progress being made in correcting hazards. The fourth report required by this legislation was to be submitted as soon as data covering the final quarter of the fiscal year could be assembled.

The Federal inspections of coal mines, supplemented by the current programs designed to familiarize mine officials and employees with the fundamentals of safe operating conditions and practices, should reduce the frequency of accidents. Such a general safety program to cover the entire coal-mining industry was never before attempted in this country.

ECONOMICS OF THE MINERALS INDUSTRIES

The Bureau's economic research activities were shaped largely by requests from the legislative and executive branches of the Government for data bearing on problems of global relief and rehabilitation, minerals procurement, technical and scientific cooperation with other governments, and national security programs.

International conferences and congressional hearings on global relief and rehabilitation began early in the fiscal year, and discussions continued until the enactment of Public Law 472, the Economic Cooperation Act of 1948. Under this law, approved on April 30, 1948, the Economic Cooperation Administration was created. Public Law 253, the National Security Act of 1947, approved in July 1947, created the National Security Resources Board and the Central Intelligence Agency. Public Law 402, approved on January 27, 1948, authorized technical and scientific cooperation with other governments on a global scale. Throughout the year, congressional hearings were held on proposals to amend present stock-piling legislation. The Congress also considered proposals for subsidies under some form of premium price plan.

All of these activities brought demands on the Bureau for large volumes of factual information. In consequence, comprehensive economic studies and investigations were conducted, and the results made available to the appropriate agencies and officials.

These activities were in addition to the heavy task of collecting data for and preparing the Minerals Yearbook, long recognized as the standard reference work on economic trends in the minerals industries. As each commodity chapter was completed, it was issued as a preprint, so as to avoid delay in making the information it contained available to the industry and the public. The complete volume was expected to be off the press in the fall of 1948.

Metals.—More than 275 annual, quarterly, and monthly reports were published containing current statistics and economic information on conditions and developments in the metals industries here and abroad. Publication of monthly statistics on industrial stocks, receipts, and use of lead was begun. To analyze the dislocations caused by two world wars, a report was published summarizing basic data on the domestic use of slab zinc since 1900, showing categories, grades, and geographic distribution. Special studies were made relating to proposed premium price plans, the strategic metals position of the United States, and mineral stock-piling considerations of the European Economic Cooperation program. Many services were rendered upon request to Members of the Congress and congressional committees. Bureau metals specialists also served on committees of the Munitions Board and were consulted by the National Security Resources Board.

Nonmetallics.—The Bureau made statistical canvasses of a few nonmetallic mineral commodities at monthly to semiannual intervals, publishing the findings as market reports. Three general reviews of developments in the nonmetallic minerals industries were prepared for trade journals. Reports of staff members on duty in Japan were published. A book on the production and uses of blast-furnace slag was being compiled in cooperation with a trade association, and several commodity chapters were prepared for a forthcoming book, "Industrial Minerals and Rocks," to be issued by the American Institute of Mining and Metallurgical Engineers.

Petroleum.—Scarcities and developments affecting national security caused an unprecedented demand for factual information on all phases of the petroleum and natural-gas industries. The Bureau achieved more timely release of many of its basic statistical data on these industries, increased its coverage of factual information, and resumed some activities that were discontinued during World War II, although fewer persons were available for this work than before the war.

Forecasts of supply and demand for petroleum and its products about a year in advance were initiated to supplement the Monthly Forecast Reports of crude-oil requirements. Publication of a monthly report on the operations of the important carbon-black industry was begun, making this information available on a current basis for the first time. Detailed statistics on the capacities of petroleum refineries in this country were compiled and published for the first time since 1941.

Late in the fiscal year, the Bureau began assembling data for a monthly report on petroleum supply and distribution in all of the principal countries. This project involves regular reports of operating data from domestic and foreign oil companies operating abroad, and from many foreign governments.

Coal.—The Bureau cooperated with the anthracite industry in urging consumers to stock coal during the summer so as to minimize winter fuel shortages. With slight modifications and with full industry support, it continued virtually all of its wartime statistical surveys on anthracite coke, and coal chemicals (byproducts), to meet the continuing need for statistical and economic data. For defense agencies, it made special studies of the coking industry's ability to produce maximum quantities of metallurgical and foundry coke.

Numerous and varied statistical and economic studies were made and many reports prepared on the production, distribution, consumers' stocks, consumption, and use of bituminous coal, anthracite, lignite, and coal chemicals. The Bureau participated in establishing the National Bituminous-Coal Council, and it worked closely with the Council and its committees in planning reports, including that on steel requirements of the bituminous-coal-mining industry. The Bureau also assisted the Anthracite Institute in its presentation of estimated steel requirements for the anthracite industry, and was carrying through with the Department of Commerce toward the allocation of steel for all mining purposes. Both as members and in preparing basic data, staff members took an active part in the work of a number of important governmental committees concerned with the peacetime and emergency availability of coals.

Foreign minerals.—Public Law 402, approved in January 1948, extended to all countries the type of technical and scientific cooperation previously restricted to the other American republics under Public Law 355 of August 9, 1939, and Public Law 63 of May 3, 1939. Global cooperative agreements having been authorized, proposals for extending technical cooperation to China and India were submitted to the Congress under the auspices of the Interdepartmental Committee on Scientific and Cultural Cooperation. A 10-year agreement with Brazil was negotiated through an exchange of diplomatic notes, and this was expected to serve as a model for similar arrangements with Mexico and Peru.

Through the cooperative effort of Bureau and Department of State officials, four more mineral specialists were to be appointed to the United States Foreign Service early in fiscal year 1949, and they were to be assigned to Malaya, West Africa, the Mediterranean area, and China.

The only regional review in the Foreign Mineral Survey series published during the year covered the mineral resources of China. It was released in January 1948.

Accident and employment data.—The public demand for reducing the hazards of the minerals industries made mine safety a primary concern of Federal and State Governments as well as of operating companies and their employees. As a result, the need for accident records, which are the unbiased indicators of safety progress, increased greatly. Besides supplying special tabulations to Government agencies, mine operators, employees' unions, and the press, the Bureau revamped its injury statistics to meet current needs. A new monthly series of reports on all coal-mine injuries and employment was initiated, and the major disaster list was revised and brought up to date. The certificates of achievement for outstanding safety work were redesigned, and nearly 1,300 of them were awarded to employees and companies. Enrollment in the National Safety Competition reached a new high of 645 mines and quarries.

As the Bureau's injury, employment, and productivity statistics are the only ones available on all the minerals industries of the United States, they are widely used by Government, international, and commercial agencies and their publications.

PUBLIC REPORTS

The volume of publications prepared and issued by the Bureau, while slightly lower than during the previous fiscal year, remained high as a result of continuing demands from industry, Government agencies, and the public for information on all phases of the minerals industries.

The results of Bureau research were made available to those who could use them, and technical papers and reports withheld during the war continued to be released for publication. In response to requests from national technical societies and the technical press, Bureau staff members prepared nearly 300 speeches and articles.

In summary, 690 manuscripts were handled, compared with 704 during fiscal year 1947 and 541 during fiscal year 1946. They included 69 chapters for the Minerals Yearbook, 206 reports of investigations, 61 information circulars, 294 speeches and articles for the technical societies and press, and 60 miscellaneous printed and processed publications. Of these, 234 dealt with fuels and explosives, including coal mining; 152, with noncoal mining; 111, with the economics of the minerals industries; 89, with metallurgy; 82, with safety and health; and the rest, with miscellaneous related topics. Handling this material involved editing more than 26,000 pages of manuscript, preparing about 2,525 illustrations, reading galley and page proofs, and indexing.

To fulfill its responsibility for keeping the minerals industries and the public informed of trends and developments, the Bureau disseminated its technologic, scientific, and economic information among those to whom it would be of value. At the same time, the number of copies of each publication was held to a minimum to conserve funds.

During the year, 4,409 books and pamphlets were added to the Bureau's Washington reference library, bringing the number of items to 72,784. As the year ended, 427 periodicals were being received and recorded, and 258 of them were circulated to Bureau staff members regularly as soon as received. For use outside the library, 28,527 books and periodicals were lent or routed. There were 4,131 telephone inquiries, and 3,894 persons visited the library to use its facilities.

All-time highs were set by the number of showings of films from the Bureau's free loan library of educational motion pictures, and by the total attendance. Bureau films were exhibited 133,070 times, up 20 percent from fiscal year 1947 and an increase of 21,895 over the former high of 130,030 showings reached in fiscal year 1941. The attendance totaled 12,575,070 persons, a 55-percent increase over the previous year. The sharp increase in attendance is attributed to use of Bureau films by television stations, which overcame the decline in average attendance resulting from the acquisition of a growing number of projectors for use in individual classrooms.

During the year, 703 new copies of films were acquired and 489 copies were withdrawn from circulation owing to obsolescence and ordinary wear. Copies of films in circulation at the close of the fiscal year totaled 5,920, a net increase of 5 percent over June 30, 1947.

Four new film subjects became available for circulation during the year—"The Story of Sulfur," a condensed version of "A Story of Texas and Its Natural Resources," "Ohio and Its Mineral Resources," and "A Story of Lead." All of these are in 16-millimeter sound, and 2 of them—the sulfur and Ohio films—are in color. Like all films in the Bureau's loan library, they were sponsored by industrial concerns that defrayed the costs incidental to production and provided the Bureau with a sufficient number of copies.

ADMINISTRATION

As in past years, activities of the Bureau of Mines were administered from Washington, D. C., but carried on largely in the field offices, laboratories, and pilot plants. The organizational structure of the

Bureau was changed to conform to the standard nomenclature recommended in Senate Report 243, dated June 6, 1947, issued by the Senate Committee on Expenditures in the Executive Departments. The Bureau of Mines organizational structure will hereafter conform to the following nomenclature in the order listed:

1. Director's Office.
2. Division.
3. Branch.
4. Section.
5. Unit.

Personnel.—On June 30, 1948, there were 3,299 full-time employees in the Bureau of Mines, distributed as follows:

Classification and number of appointees

	P&S	SP [1]	CAF	CPC [2]	Total
Departmental	89	0	354	9	452
Field	823	422	732	870	2, 847
Total	912	422	1, 086	879	3, 299

[1] Includes instrument makers, safety instructors, laboratory aids, assistants, etc.
[2] Includes laborers, mechanics, messengers, wage employees, etc.

Property.—As of June 30, 1948, the property of the Bureau had a total valuation of $20,055,253.89, of which $2,200,121.50 was for land and $7,511,405.63 for buildings and improvements; $3,769,437.88 for laboratory equipment; $3,047,194.59 for machinery and power-plant equipment; and $3,527,094.29 for automobiles and trucks, office furniture and equipment, rescue equipment and specialized apparatus, and other goods.

Finance.—The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1948, including direct appropriations, departmental allotments, reappropriated balances, and sums transferred from other departments for service work, were $21,788,965. Of this amount $20,165,446 was spent, leaving an unexpended balance of $1,623,519. On the regular work of the Bureau, $18,769,286 was expended. These figures are subject to revision because of unpaid obligations.

Table 1 presents classified information regarding the financial history of the Bureau for the fiscal years ended June 30, 1945–48.

Table 2 gives a statement of the distribution of congressional appropriations to the divisions and branches, and the expenditures of these funds in 1948 by Bureau divisions.

TABLE 1.—*Bureau of Mines appropriations and expenditures, fiscal years ended June 30, 1945–49*

Fiscal year	Appropriated to Bureau of Mines	Departmental allotments [1]	Funds transferred from other departments [2]	Total funds available for expenditures	Unexpended balances	Total expenditures	Expenditures, exclusive of service items [3]
1945	$22, 195, 136. 55	$91. 500	$6, 260, 167. 74	[4] $28, 988, 520. 00	[5] $8, 556, 166. 67	$20, 432, 353. 33	$19, 656, 644. 67
1946	17, 846, 838. 69	[9] 6, 500	2, 384, 271. 00	[5] 25, 301, 457. 69	[6] 8, 050, 809. 69	17, 250, 648. 00	16, 009, 760. 00
1947	16, 000, 515. 00	[9] 7, 800	1, 641, 243. 00	[6] 26, 052, 579. 00	[7] 10, 114, 009. 00	15, 938. 570. 00	14, 885, 652. 00
1948	18, 714, 181. 00	[9] 6, 500	3, 068, 284. 00	[7] 21, 788, 965. 00	[8] 1, 623, 519. 00	20, 165, 446. 00	18, 769, 286. 00
1949	22, 897, 637. 00	[9] 6, 500	1, 526, 571. 00	[8] 24, 430, 708. 00	----------	----------	----------

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[1] Includes printing and binding, stationery, and contingent funds.

[2] Includes proceeds from sales of residue gas.

[3] Service items include helium and other investigations and services for other departments.

[4] Includes $4,603,644 unexpended balance reappropriated, and balance of $291,152 receipts from sale of helium and other products.

[5] Includes $4,678,164 unexpended balance reappropriated, and balance of $385,684 receipts from sale of helium and other products.

[6] Includes $3,176,386 unexpended balance reappropriated, and balance of $457,684 receipts from sale of helium and other products.

[7] Includes $6,501,988 unexpended balance reappropriated, and balance of $800,727 receipts from sale of helium and other products.

[8] Includes $81,471 unexpended balance reappropriated, and balance of $720,155 receipts from sale of helium and other products.

[9] Includes stationery and contingent funds.

TABLE 2.—*Bureau of Mines expenditures, fiscal year 1948*

Division or branch	Salaries and expenses	Operating rescue cars and stations and investigation of accidents	Coal-mine inspections and investigations	Testing fuel	Anthracite investigations	Construction and equipment of anthracite research laboratory	Synthetic liquid fuels	Mineral mining investigations	Investigation and development of domestic mineral deposits	Coal investigations	Oil and gas investigations
Office of the Director	$29, 191										
Office of Minerals Reports	2, 788	$42, 970	$63, 747	$512			$68, 733		$38, 313		$111
Total	31, 979	42, 970	63, 747	512			68, 733		38, 313		111
Administrative Division	79, 968	4, 724	119, 012	22, 828	$6, 333		125, 126	$22, 847	40, 539	$4, 881	30, 938
Mining Division	225							124, 951	833, 085		
Metallurgical Division	771							232, 219	147, 755		
Fuels and Explosives Division:											
Coal Branch	4, 619	167, 489	70, 882	260, 239	71, 494	$448, 631	80, 647			69, 829	
Explosives Branch		322, 179									
Fuels Utilization Branch	468			115, 629							
Petroleum and Natural Gas Branch	448						1, 963, 267				568, 777
Synthetic Liquid Fuels Branch							7, 106, 124				
Total	5, 535	489, 668	70, 882	375, 868	71, 494	448, 631	9, 150, 038			69, 829	568, 777
Economics and Statistics Division:											
Coal Economics Branch	2, 170										
Foreign Minerals Branch	123										
Metal Economics Branch	36, 811										
Accident Analysis Branch	2, 636		21, 335								
Nonmetal Economics Branch	1, 727										
Petroleum Economics Branch	336										
Total	43, 803		21, 335								
Health and Safety Division:											
Coal Mine Inspection Branch			1, 509, 843								
Safety Branch		538, 394	22, 743		26, 570						
Health Branch		72, 000	66, 566								
Total		610, 394	1, 599, 152		26, 570						
Total appropriations	162, 500	1, 148, 000	1, 875, 000	400, 000	105, 000	450, 000	[2] 9, 419, 999	440, 300	1, 060, 000	75, 000	600, 000
Total expenditures	162, 281	1, 147, 756	1, 874, 128	339, 208	104, 397	448, 631	9, 343, 897	380, 017	1, 059, 692	74, 710	599, 826
Balances	219	244	872	792	603	[1] 1, 369	[1] 76, 102	[3] 60, 283	308	290	4761

See footnotes at end of table.

TABLE 2.—*Bureau of Mines expenditures, fiscal year 1948*—Continued

Division or branch	Expenses, mining experiment stations	Metallurgical research and pilot plants	Care, etc., buildings and grounds, Pittsburgh, Pa.	Economics of mineral industries	Helium utilization and research	Helium production	Development and operation of helium properties (special fund)	Reduction of zinc concentrates with methane gas	Drainage tunnel, Leadville, Colo.	Missouri River Basin (reimbursable)	Cooperation with the American Republics
Office of the Director				$4, 719							
Office of Minerals Reports	$27, 572	$13, 816		18, 801	$1, 372	$7, 540					
Total	27, 572	13, 816		23, 520	1, 372	7, 540					
Administrative Division	32, 981	41, 555	$139, 925	75, 577	3, 116	13, 609	$2, 769			$3, 705	
Mining Division	206, 005								$2, 510	99, 183	
Metallurgical Division	753, 264	944, 184									
Fuels and Explosives Division:											
Coal Branch	39, 833									7, 813	
Explosives Branch											
Fuels Utilization Branch											
Petroleum and Natural Gas Branch					85, 507	305, 964	370, 546				
Synthetic Liquid Fuels Branch											
Total	39, 833				85, 507	305, 964	370, 546			7, 813	
Economics and Statistics Division:											
Coal Economics Branch				147, 616							
Foreign Minerals Branch				44, 428							$47, 819
Metal Economics Branch				193, 820							
Accident Analysis Branch				68, 094							
Nonmetal Economics Branch				58, 967							
Petroleum Economics Branch				67, 806							
Total				580, 731							47, 819
Health and Safety Division:											
Coal Mine Inspection Branch											
Safety Branch											
Health Branch											
Total											
Total appropriations	1, 060, 000	1, 000, 000	140, 000	680, 000	90, 000	338, 392	1, 093, 470	$761	3, 621	131. 953	50, 469
Total expenditures	1, 059, 655	999, 555	139, 925	679, 828	89, 995	327, 113	373, 315		2, 510	110, 701	47, 819
Balances	345	445	75	172	5	11, 279	[1] 720, 155	761	[1] 1, 111	[1] 21, 252	2, 650

Division or branch	Metallurgical research and pilot plants contributions	Payments from proceeds of sales, motor-propelled vehicles, etc.	Working funds	Contingent expenses	Totals
Office of the Director					$33, 910
Office of Minerals Reports					286, 275
Total					320, 185
Administrative Division			$84, 842	$6, 492	861, 767
Mining Division		$35, 410	64, 073		1, 365, 442
Metallurgical Division		2, 853	187, 644		2, 268, 690
Fuels and Explosives Division:					
Coal Branch			99		1, 221, 575
Explosives Branch			224, 599		546, 778
Fuels Utilization Branch			1, 903		118, 000
Petroleum and Natural Gas Branch			123, 535		3, 418, 044
Synthetic Liquid Fuels Branch					7, 106, 124
Total			350, 136		12, 410, 521
Economics and Statistics Branch:					
Coal Economics Branch			3		149, 789
Foreign Minerals Branch					92, 370
Metal Economics Branch					230, 631
Accident Analysis Branch					92, 065
Nonmetal Economics Branch					60, 694
Petroleum Economics Branch					68, 142
Total			3		693, 691
Health and Safety Division:					
Coal Mine Inspection Branch					1, 509, 843
Safety Branch			9, 034		596, 741
Health Branch					138, 566
Total			9, 034		2, 245, 150
Total appropriations	$4, 000	50, 668	1, 403, 332	6, 500	21, 788, 965
Total expenditures		38, 263	695, 732	6, 492	20, 165, 446
Balances	[1] 4, 000	12, 405	[4] 707, 600	8	1, 623, 519

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[1] Available for expenditure in fiscal year 1949.

[2] Includes $4,410,944, portion of $15,000,000 contract authorization not appropriated.

[3] Reserve specified by the Budget Bureau, $60,000.

[4] $704,654 of balance available for expenditure in fiscal year 1949. $2,946 lapsed as of June 30, 1948.

Geological Survey

W. E. WRATHER, *Director*

MODERN civilization is dependent on the use of large quantities of three natural resources: metals and minerals for machines; fuel for power and heat; and water for power, irrigation, industry, and the home. These resources come from the earth, and their most efficient discovery and development require a knowledge of geology. In the fiscal year 1948 the Geological Survey—as it has since its organization in 1879—remained the hub of Federal activities relating to the discovery, evaluation, development, and conservation of the Nation's mineral and water resources. During the year considerations of national security kept the activities of the Geological Survey focused even more intently than before on problems relating to the discovery and appraisal of mineral raw materials and this work has been expanded to the limit of available facilities.

Geologic Branch

Progress has been maintained in all important directions, including the long-range program of systematic field and laboratory studies designed to determine the ultimate capacity of this country to produce the quantities of mineral raw materials that our industrial structure requires, in the immediate and long-range programs which assist the mineral industries in meeting these requirements, and in the correlative programs of general research and completion of the geologic map of the United States. Geologic maps are an essential tool in many fields, not only in the search for and appraisal of mineral and water resources, but also in providing background information for mineral and mining technology; in land classification; in soil conservation and soil sciences; in the activities of the National Parks; in dam, highway, and other kinds of heavy construction; and in military planning. Details of the activities of the Geologic Branch are outlined in the reports that follow.

MINERAL DEPOSITS

The Geological Survey's newly assigned functions of physical exploration in the search for mineral deposits and appraisal of the Nation's mineral resources, as well as the ever-increasing interest in strategic and critical minerals and the recognition of their significance to the Nation, made it desirable early in the fiscal year 1948 to consolidate the Sections of Metalliferous Deposits and Nonmetalliferous Deposits into the new Section of Mineral Deposits. Many overlapping functions have thereby been eliminated, and the administration of the expanded program of broad-gage research, geologic mapping, and exploration of mineral deposits has been greatly facilitated.

Seventy-one projects were active in 28 States in the field of metalliferous and nonmetalliferous geology. Because of the critical need for base metals, 24 of the projects dealt with copper, lead, and zinc and 15 with deposits of iron and ferroalloy minerals, such as tungsten, chromite, and manganese. An extensive study of the phosphate deposits in Florida, Idaho, Montana, and Utah was begun, and considerable attention was given to the geology of pegmatites, as sources of feldspar, mica, tantalum, beryllium, and lithium minerals. Investigations were also continued on mercury, alunite, bentonite, fluorspar, magnesite, potash, talc, and granites. Thirty-four long-range projects of geologic mapping and related laboratory investigations, begun prior to July 1, 1947, were continued throughout the fiscal year 1948. Five exploratory drilling projects—one each in Arizona, Colorado, Idaho, South Dakota, and New York—were undertaken and three of them completed during the fiscal year. The project in the Gouverneur district, New York, which was started in the fall of 1944 in search of Navy-grade talc for war purposes is of particular interest. Exploration by private companies based in large part upon the map findings of the United States Geological Survey work have in the past year and a half demonstrated the presence of a hitherto unknown continuation of the talc-bearing zone and a consequent doubling of the talc reserve in that region. The newly discovered body is now being actively developed by industry.

Geochemical prospecting for mineral deposits by chemical studies of soil, vegetation, and water was carried on by six field projects in Arizona, Colorado, New York, Tennessee, Utah, and Wisconsin. In addition, 10 minor field studies were made. The greatest emphasis in geochemical prospecting has been placed on the development of quick analytical tests that may be used under field conditions. Research and development work on five of such tests, which are the basic tools on which geochemical prospecting depends, has been done. Greenhouse experiments on growing plants in soils containing known concentrations of copper, lead, and zinc were in progress during the year to supply background data on plant behavior in the simulated environment of mineral deposits.

Cooperative agreements for geologic work in 10 States were continued while cooperation with other bureaus in the Department was expanded to the mutual benefit of the bureaus and the public. In this connection six field projects were under way in the Missouri River

Basin as a part of the Department's development program of this area. As a result of completed studies six maps, with marginal texts, showing the occurrences of sand and gravel, construction materials and nonmetallic mineral resources, metallic mineral deposits, and other raw materials have been released as part of the Survey's cooperation with the Missouri River Basin program.

New publications for the year embraced a wide range of subjects including cobalt, lead, magnetite, manganese, silver, tungsten, fluorspar, construction materials, and geochemical prospecting; and comprised 1 professional paper, 3 bulletins, 1 circular, 7 preliminary reports and maps, 15 open-file reports and maps which were made available for public inspection and 6 Missouri Basin studies. In addition, 15 reports prepared by the section were published by State agencies under the cooperative agreements, and 27 papers and abstracts of reports were published in professional and technical journals.

FUELS

The program of accumulation and interpretation of fundamental geologic data to delineate new areas in which the geologic relations are favorable to the occurrence of oil and gas was maintained. This program, begun in July 1943, has yielded geologic data of inestimable value and the data have been released promptly to the oil industry in the form of preliminary maps and charts. During the fiscal year, 19 maps and charts were printed covering investigations that had been completed in Alabama, Colorado, Georgia, Mississippi, Montana, New Mexico, Ohio, Utah, Virginia, and West Virginia. About 17,000 copies of these and earlier maps and charts were sold during the year, bringing the total sales to nearly 90,000 copies. In this connection field sales offices at Tulsa, Denver, Casper, Billings, and Los Angeles have been established to make the data more promptly available to the public.

By maintaining close relations with the oil and gas industry, State geological surveys, and other interested geologic organizations, the United States Geological Survey has been able to devote much of its efforts to the study and solution of regional problems of large scope. Major investigations were conducted during the year in 19 States—Alabama, California, Colorado, Florida, Kansas, Kentucky, Michigan, Montana, New Mexico, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Texas, Utah, Virginia, West Virginia, and Wyoming.

These investigations ranged from detailed surface studies of the stratigraphy and structure of the Coast Ranges in Oregon to subsurface correlations of samples, cuttings, and cores of deep wells in Florida, and from studies of the oil-bearing formations of Texas to the detailed bed-by-bed correlation of the black shales of New York. As with other geologic endeavors, the fruitfulness of this effort has grown steadily with continuity of support.

OIL SHALE

Although other needs have thus far precluded the intensive work needed on oil shales, the Geological Survey has maintained an active interest in this work. During the fiscal year 1948 the preliminary report on the investigation of Naval Oil Shale Reserves 1 and 3 and adjoining areas near Rifle, Colo., was completed and transmitted for publication. This first modern detailed survey and correlation of oil shale beds with a resulting accurate appraisal of reserves in several categories will set a new standard of mapping and geologic appraisal of oil shale reserves. Primarily executed for and in cooperation with the Bureau of Naval Petroleum Reserves, the published report has been awaited with keen interest by the companies engaged in active drilling and testing of oil shale in western Colorado. At the close of the year, further field investigations were begun in the area west of the naval oil shale reserves. Considerable field data were obtained on the distribution and thickness of some of the oil shale beds of Tennessee.

COAL

One of the most urgent tasks confronting the Geological Survey is the definitive reappraisal of the coal reserves of the United States. Under the existing need for accurate reliable data on this basic energy resource, it is obvious that rough generalizations, reconnaissance appraisals, or hurried reviews are neither adequate nor defensible. The geologic evidence for thickness, inclination of beds, dislocation of the strata by earth movements, extent and distribution of the beds and thickness of cover beneath which they lie must be examined in detail by experts in this field. Fortunately, the Survey was able during the fiscal year 1948 to make the long-desired beginning of this detailed examination by initiating a complete study and computation of the available data on coal reserves of Montana, now of such vital significance as a potential source of synthetic fuels. This study and the preparation of an accompanying coal resource map of Montana were carried well toward completion during the year and will serve as a pattern for similar studies of other States.

A modest and heartening expansion of the basic geologic studies needed to provide the data for authoritative coal reserve computations was also possible. During the year, a preliminary report on the geology and reserves of the coking coals of the Paonia coal field, Colorado, was published and work on the final report was continued. Field work was continued throughout the year in the Deep River coal field of

North Carolina, to provide encouragement and data necessary to the development of this favorably located field. These projects were conducted in conjunction with Bureau of Mines investigations. The Geological Survey also continued field studies in the Durango field, Colorado, where supplies of coking coal are believed to occur. The investigation of the geology and structure of the Pennsylvania anthracite fields was initiated with a study of part of the western middle basin from a new field office in Mount Carmel, Pa., and late in the year the long-needed investigations of Pacific Northwest coals were begun in Lewis and Thurston Counties, Wash. Office compilation of the reports on the Birney-Broadus, Moorhead, and Coalwood coal fields of Montana was brought close to completion.

GENERAL GEOLOGY

As pointed out in the Geological Survey's budget for 1947, less than 10 percent of our country has been mapped geologically on scales adequate for modern use. We rank with backward nations of the world—far below England, France, Germany, Japan, and Italy. The status of geological mapping in the United States is comparable to that of Poland and Algeria—we are a little behind Algeria but we are ahead of Poland. Information on Russia is not as certain as might be desired, but present reports indicate that Russia has completed about the same proportion of geologic mapping as we have but is mapping today at a much higher rate than we are.

The other nations have not mapped their areal geology for the entertainment of their scientists. They have done it out of realism and hard necessity, with the recognition that areal geologic mapping provides the essential background for adequate appraisal of natural resources and land potential. There is no other way.

As a result of increased appropriations to the Geological Survey the rate of general geological mapping has been greatly increased over the prewar rate. There remain to be mapped approximately 12,000 15-minute quadrangles, and if these are to be mapped as early as 1980 the annual completion rate would have to average 400 quadrangles. The present rate of mapping is still only about one-sixth of the average necessary to complete the work in 30 years.

Although the Geological Survey can furnish the leadership to accomplish the vast mapping program that is needed, it cannot do the job unaided. A program is needed that would enable our universities and State surveys to participate in the mapping to the degree they are able and willing to do so. To mobilize the geological profession to this task is in itself a major undertaking. It would require a planning organization representing the mineral industries, universities, State surveys, and the Federal survey in order to:

(1) Determine the capacity of all institutions, public and private, who are able and willing to participate in an integrated and federally sponsored program of general geological mapping.

(2) Survey the situation with regard to the total capacity available for editing and drafting of maps and map reproduction.

(3) Inventory the capacity of the Federal survey, State surveys, universities, and private concerns to provide the specialized services such as paleontologic studies and chemical analyses needed in connection with the mapping.

(4) Develop an orderly plan for embarking on the program, including plans for forms of contracts and for the various administrative management procedures and controls that will be needed.

(5) Recommend new legislation that might be needed to govern contracting agencies and individuals so that the new mineral and other discoveries that can confidently be expected from such a program will be available to the general public in the same manner as those made in the past under the regular program of the United States Geological Survey.

As a first step in such planning the Survey has prepared, for every State, a bibliographic index of all published geologic maps. The staff necessary for keeping the index current is being organized so each State index map can be brought up to date periodically and reissued. Work has been started toward the recording of all current geologic mapping activities.

Scientific data accumulate slowly, and the full importance of any particular study cannot be appreciated until the relation of each fact to a host of other facts has been evaluated. It should also be pointed out that most major scientific discoveries are accidents resulting from scientists' probing into the realm of the unknown. The practical results of any particular research cannot always be predicted—if they could be, the research would be unnecessary. The social and economic implications of a new scientific discovery rarely can be appreciated until the discovery has been tested by time. Although a fiscal year is too brief for adequately reporting scientific progress, some examples can be cited to illustrate the kind of problems that were investigated in the fiscal year 1948.

In the field of structural geology new concepts regarding the mechanics and forces involved in crustal movements were evolved as a result of studies in the Great Smoky Mountains National Park and in New England. In addition to providing fuller information about the composition and structures of those areas the studies are providing entirely new information about the fundamental processes involved, information that will have application to other parts of the country. These new concepts are still in the realm of theoretical information, but it is from precisely such theoretical concepts that practical applications later develop. Structural studies in the Great Basin area of Nevada, western Utah, and southern California have discovered places where present-day crustal movements are suspected. Moreover, those studies indicate that the present-day movements are the continuation of movements that began long ago. Man cannot hope to control such crustal movements and related earthquakes, but by understanding their history and mechanics he can hope to protect himself against disaster.

Studies in the Missouri River Basin (under funds transferred from the Bureau of Reclamation), and in New England added considerably to knowledge of glacial and related deposits. In New England these studies already have had important applications to highway construction, flood control, and shoreline protection. The geologists there have been able to predict, successfully, depth to bed-rock (for bridge piers, etc.), nature of subsurface material to be excavated in cuts (to avoid excessive excavation costs), and adequate sources of road and other constructional materials, and to advise with respect to most favorable route sites so that unstable foundations, such as in areas of poor subdrainage, may be avoided.

Studies in Utah, northern Pennsylvania, and eastern Maryland have contributed considerably to better understanding of the effect of geologic processes on soil genesis. In this connection it should be pointed out that one fossil soil discovered in Utah may prove to be a valuable mineral resource. It is a lime-free clay, one of the few in that region, and tests by the Bureau of Standards indicate that it has superior properties for the manufacture of structural clay products.

A program of volcano research and related military engineering studies in the Aleutian area of Alaska, begun in the fiscal year 1946, was continued through the fiscal year 1948, with the support of the National Military Establishment. Field projects were carried on near Fort Randall on the Alaska Peninsula, near Fort Glenn on Umnak Island, near Dutch Harbor, and near several military bases in the western Aleutian Islands. A volcano and earthquake observatory was in operation at Adak, largest base in the Aleutians.

The program now under way is expected to yield completed terrain intelligence for basic military needs by the end of the fiscal year 1953; completed geologic reconnaissance mapping of all significant parts of the region by the end of the fiscal year 1956; and, within the next decade, real progress toward understanding the volcanic mechanism and predicting eruptions.

GEOPHYSICS

Geophysical exploration during the fiscal year 1948 continued to furnish data on subsurface geologic conditions not obtainable through surface studies alone. Both aeromagnetic and ground geophysical surveys were performed.

Speed, economy, and accuracy are characteristic of the operation of an airborne magnetometer that was developed during the latter part of the war by the Geological Survey working with the Naval Ordnance Laboratory. Aeromagnetic surveys provided geologic information on a regional scale on such diverse problems as the possible extensions of the iron ranges in the Lake Superior region, the location of buried igneous intrusions and hills which may control entrapment of oil in the overlying sedimentary rocks in Indiana and Mississippi, the geologic structure controlling lead mineralization in southeast Missouri, the structure and volcanism in the Aleutian Island arc, and the origin of atolls in the northern Pacific. In all, a total of 66,400 miles of useful aeromagnetic traverse was flown, covering 36,000 square miles in seven states and in the Aleutian and northern Pacific Islands. The latter surveys were flown in cooperation with the Office of Naval Research.

Experimental and routine ground geophysical surveys were made in nine States, the District of Columbia, and Alaska for such various purposes as determining the extension of oil sands from producing wells, locating ground water and buried river channels, obtaining information on metallic mineral deposits, and measuring the depth and extent of permafrost in Alaska. In addition, precise determinations of variations in the value of gravity were made for the Bureau of Standards in the District of Columbia and for the Coast and Geodetic Survey in Kansas and Oklahoma, and seismic observations in the Aleutian Islands were continued as part of the program of volcano research.

Theoretical investigations of the magnetic and gravitational effects of idealized geologic bodies were continued. The purpose of these studies is more precise interpretation of geophysical data obtained under actual conditions, and particularly more accurate estimates of the depth to ore deposits and other geologic bodies. Theoretical investigation of the flow of electric current through several laterally homogeneous layers was also continued. The purpose of this investigation is a more satisfactory interpretation of electrical resistivity measurements in terms of depth and thickness of rock formations, where several beds are involved.

In the laboratory and instrument shop a new type of magnetometer was designed and constructed and is now undergoing field tests. This magnetometer is based on a new principle of operation and promises to simplify absolute determinations of magnetism.

Construction of a second three-component seismograph was completed for observations at Adak in connection with the program of volcano research. The first of several portable drill core orientation devices was completed for use by field geologists of the Geological Survey. This device permits determination of the original orientation of the rock cores with reference to the earth's magnetic field, and hence with reference to the earth's surface. Automatic current controls and recorders were built for earth-resistivity measurements, a simplified device was constructed to locate faulty insulation and breaks in wires, and a 25 kilovolt-ampere electrical resistivity apparatus was completed for oil exploration down to 5,000 feet. In addition, the shop maintained and repaired all apparatus used in ground geophysical surveys.

GEOCHEMISTRY AND PETROLOGY

The fiscal year 1948 was the first full year of activity for the combined section of Geochemistry and Petrology. The year was marked by rapid expansion of the Trace Elements unit, engaged in work on fissionable materials, and much of the section's work therefore consisted of planning and procuring laboratory space and equipment and the necessary personnel.

The section is concerned primarily with the application of specialized techniques of chemistry, physics, mineralogy, and petrology to the solution of geological problems of both theoretical and economic importance. This application is made in various ways:

(1) Research on methods. Search for better methods and work on improvement of known techniques is under way constantly. Noteworthy developments during the fiscal year 1948 included perfecting a rapid method for field determination of zinc, working out a new and very rapid method for determination of uranium in low-grade material, and devising a much-improved apparatus for quantitative spot-testing for several elements.

(2) Direct attack on geological problems by members of the section, either by laboratory or combined field and laboratory techniques. During the year, six major projects of this nature and many problems of lesser scope have been under way. These range from study and description of new minerals through comprehensive studies of mineral groups to regional studies requiring the application of a variety of methods.

(3) Cooperative projects with other sections. The work of such projects has resulted in the discovery of three potential and previously unknown clay deposits in Utah and has indicated a possible method for increasing readily accessible reserves of commercial bentonite. An important part of the work of the section is making determinations for Survey geologists. Some hundreds of these were made during the fiscal year 1948, ranging from rapid determinations of specimens to complete chemical analyses.

These and similar projects and problems will be continued in the future. To keep pace with the expanding scope and functions of the Geological Survey, still other techniques and methods must be brought to bear on geologic problems, especially the use of some of the powerful modern tools of research not yet available to the section. As funds, space, and personnel become available, the following projects will be undertaken as rapidly as possible:

(1) Acquisition of an electron microscope for studies of finer details of structure than can be observed by other methods.

(2) Acquisition of a mass spectrograph for determinations of isotopic composition and for certain types of analyses.

(3) Establishment of a physical laboratory for the precise determination of physical properties of minerals and rocks and their correlation with chemical composition and geological environment.

(4) Establishment of a microchemical laboratory for the analysis of amounts of material too small to be analyzed by ordinary methods, and to develop and improve methods for determining traces of various elements.

(5) Initiation of a program of radioactive age determinations.

(6) Research on methods of determination of radioactive materials by counting.

Plans are actively under way on each of these projects. To head the new research program, personnel is available for four of the six projects. Equipment is available, on order, or will be ordered shortly for five of the six. Space can be provided for all six in the new Trace Elements laboratory in Washington.

PALEONTOLOGY AND STRATIGRAPHY

The section of Paleontology and Stratigraphy continued to support the work of the economic geologists by supplying specialized assistance in the identification and correlation of strata, particularly by the use of fossils. It has also carried out fundamental investigations in the field and laboratory on faunas and floras to provide improved bases for stratigraphic judgments and to expand knowledge of the ancient life of the earth. Besides numerous examinations of fossils submitted by field geologists and consultation with field parties on the ground, studies have been made of the Woodbine formation of Texas, the Jurassic stratigraphy and faunas of the Western Interior region and Alaska, the stratigraphy and floras of the late Cretaceous and early Tertiary rocks of the Western Interior region, the echinoid faunas of the Eastern United States, the foraminiferal faunas of various regions, the stratigraphy and the conodont faunas of the black shales of the Eastern Interior region, the invertebrates of the phosphate-bearing rocks of Idaho and Montana, the stratigraphy and floras of certain diatom-bearing rocks of California that are especially important to the petroleum geologist, and the fossil faunas of the Canal Zone. Most of these investigations are long-range continuing projects and it is planned to carry them on in the fiscal year 1949. It is planned also to initiate studies needed in several fields, such as the stratigraphy of the Triassic rocks of the Rocky Mountain and Great Basin regions and the faunas of the Silurian rocks of Alaska.

ENGINEERING GEOLOGY

The Geological Survey's engineering geology program, with headquarters in Denver, continued at about the same scale as in the fiscal year 1947, and with the same emphasis—to provide basic geologic data that can be applied to construction problems by civil engineers or project geologists. The identifying feature of this geologic mapping program is the interpretation of each formation in terms of its foundation and excavation characteristics and its suitability and availability for use as a material for construction, such as aggregate, riprap, structural stone, road metal, or fill. Geologic mapping is supplemented by consulting well logs, exploratory boring data, geophysical surveys, and the results of laboratory tests, and by observing performance characteristics of materials in use. The purpose of the maps and reports is to provide a three-dimensional picture of a given area, showing the position and physical properties of the underlying unconsolidated and bedrock formations, on which proposed locations for highways, tunnels, bridges, airports, subways, sewer systems, aqueducts, dams, reservoirs, and canals can be projected so that geological conditions affecting design and construction can be foreseen.

Mapping projects active during 1948 are tied in with construction plans of the Bureau of Reclamation in North Dakota, Kansas, and central Utah, the United States Engineers' Lower Monumental dam site on the Snake River in Washington, and the Puerto Rico Water Resources Authority's dam and tunnel sites. Detailed mapping of city areas, an important feature of this program, was started in San Francisco, Portland (Oreg.), and Anchorage, Alaska. Construction materials resource studies included a map and report on sand and gravel resources of Wyoming, reports on the geology and construction materials of several counties in Kansas (cooperative with the State Highway Commission), and light-weight aggregate sources in Colorado. Active landslides in Colorado and Utah were mapped in detail. A geologic dictionary for engineers was compiled and foreign technical articles were translated and abstracted. Preliminary maps and reports were made available to interested construction agencies, and progress was made toward publication of final reports.

In addition to regularly scheduled projects, brief geologic investigations relating to specific construction problems were made during the year at the request of Public Buildings Administration, Rural

Electrification Administration, Navy Bureau of Yards and Docks, Veterans' Administration Construction Service, and insular agencies in Puerto Rico.

During the fiscal year 1949 it is planned to start mapping the engineering geology of Knoxville, Tenn., and vicinity, and the Republican River Valley, Nebr.

MILITARY GEOLOGY

The Washington research group of the Military Geology Section continued the preparation of intelligence reports for the Corps of Engineers and other branches of the armed services. In the fiscal year 1948, nine major reports were completed, one of which, Technical Manual 5–254, Military Geology, will be published by the Adjutant General's Office, United States Army, and given Army-wide distribution for use as a guide in training or operations involving the application of geology to military problems. In addition, 36 shorter reports were completed. These studies deal with terrain analysis, construction materials, water supply, airfield sites, construction of underground installations, permanently frozen ground, and mineral resources.

Geologic and soils mapping of Fort Benning, Ga., was completed, and preparation of maps and texts for the military geology folio of that reservation is well under way.

Studies of Japanese mineral resources were completed for the Natural Resources Section, General Headquarters, Supreme Command for the Allied Powers. The report on copper resources was published; five other reports are complete but as yet unpublished.

Field work was completed on the geologic map of Yap; Okinawa and Palau will be completed early in the fiscal year 1949. Field work on Guam began in July 1948. Four reports were completed concerning the geology and mineral resources of Micronesia. Reports on the reefs of Bikini, Marshall Islands, and on the submarine geology of Bikini were completed. These as well as two other studies still under way, are the result of field studies in connection with the Bikini resurvey of 1947.

Field studies of permafrost and related terrain factors were continued on Seward Peninsula, the Arctic slope of Alaska, and in the vicinity of Fairbanks. Studies were initiated on St. Lawrence Island and on the Yukon and Kuskokwim Rivers. A special field study requested by the Alaska Railroad resulted in a report on the railroad track difficulties (landslides and icing) in the Nenana River Gorge.

One geologist was assigned to Task Force 39, a United States Navy Antarctic expedition. A geologist remained on assignment to the Manila Engineer District as engineering geology consultant in the reconstruction of the city; and one geologist was assigned to the Engineer Division, European Command, United States Army, as a special consultant.

GEOLOGIC INVESTIGATIONS IN ALASKA

During the fiscal year 1948 the Geological Survey developed details for a long-range program of geologic mapping in Alaska. Projects geared to this plan, plus projects initiated during the war years at the request of other government agencies, constituted the Geologic Branch program in Alaska.

Within the Geologic Branch, the Alaskan Section program included investigations of metals, nonmetals, coal, petroleum, and trace elements. In planning the 1948 program, special attention was given to organizing those projects most apt to aid in short-range Territorial development. Other projects conformed to the Geologic Branch long-range plan for geologic mapping in the Territory.

Work was continued on the study of the Juneau gold belt, a geologic mapping project on Chichagof Island, and the investigation of the gold, quicksilver, and antimony deposits in the Kuskokwim area. An examination was made of the lead-zinc deposits in the vicinity of Berg Basin, southeast of Wrangell. In the spring of 1948, geologic mapping in the Willow Creek mining district was started.

Nonmetals work was focused primarily on limestone deposits in southeastern Alaska and in the Railroad Belt. General geologic mapping of significant limestone deposits on the west coast of Prince of Wales Island was begun, and a detailed examination was made of limestone deposits adjacent to the Alaska Railroad west of Windy Station. Reconnaissance examinations were made of a large number of limestone occurrences in southeastern Alaska.

Geologic mapping in coal-bearing areas was continued in the Nenana coal fields. A long-range program for the mapping of the coal resources of western Kenai Peninsula was begun. Investigations for oil were continued in southern Alaska in the Yakataga area.

The work of the Alaskan Section continues to be influenced by the needs of the Department of National Defense for basic geologic data. The program of petroleum exploration and mapping in northern Alaska begun in the 1944 field season and supported by the Navy continued in the fiscal year 1948.

WORK IN OTHER AMERICAN REPUBLICS

The Eighth Pan American Scientific Congress met in Washington in the spring of 1940. There representatives of the various American Republics found a medium for the exchange of ideas and a common ground for the cementation of friendships. The Department of State, recognizing the role of science in Pan American relationships, sought through the Interdepartmental Committee on Scientific and Cultural Cooperation a means for continuing the inter-American scientific spirit that prevailed in the Congress and, in the summer of

1940, the Geological Survey was allotted funds for geological investigations in cooperation with the other American Republics.

These cooperative geologic appraisals of mineral deposits are based on detailed geologic mapping of selected mineral deposits potentially important in hemisphere trade. The field work is conducted cooperatively by United States and Latin American geologists after agreement between the appropriate governmental authorities. Together they map the deposits and make supplementary studies needed to arrive at an evaluation of ore reserves. Joint reports are prepared with maps containing bilingual legends. These reports are published in English as chapters of the Geological Survey's bulletin series entitled "Investigations in the American Republics." The reports of Brazilian deposits are also published in Portuguese as bulletins of the Departamento Nacional da Producão Mineral.

The reports of Mexican deposits are published in Spanish as bulletins of the Comité Directivo para la Investigación de los Recursos Minerales de México. In Argentina a report on cooperative studies of tungsten in that country is being published in Spanish by the Dirección de Minas y Geología. Recently the Dirección de Montes, Minas, y Aguas of Cuba expressed its intent to publish Spanish editions of the joint studies of Cuban chromite, manganese, and tungsten deposits.

Argentina.—In 1942 and 1943 a Survey geologist worked in cooperation with the Dirección de Minas y Geología on tungsten investigations. Their report is published as Bulletin 954–A. One geologist from Argentina has completed in-service training with the Survey. Three Argentine geologists are now assigned to Survey field parties in the United States for in-service training.

Brazil.—Cooperative work with the Departamento Nacional da Producão Mineral began in 1940 and is continuing with emphasis on the study and area-mapping of the high-grade iron ores of Minas Gerais. Among the mineral deposits already studied are beryl, bauxite, cobalt, manganese, and tungsten. The reports published concern nickel-silicate and associated nickel-cobalt-manganese oxide deposits near São José do Tocantins, Goiaz (Bull. 935–E), and manganese and iron deposits of Morro do Urucum, Mato Grosso (Bull. 946–A). The latter deposit, with an inferred reserve of 17 million tons of 45½ percent manganese, is the largest deposit of that material in the Western Hemisphere. Both reports have also been published in Portuguese and the following reports are in preparation for publication: Barite deposits of Camamú, Bahia; magnesite deposits of Brumada, Bahia; magnesite deposits of Ceará; mica deposits of eastern Minas Gerais; and stratigraphy of southern Brazil.

At the present time two Geological Survey geologists and two topographers are working with their Brazilian colleagues on a study of great economic interest to both countries. One young Brazilian geology professor from the University of São Paulo has completed in-service training with Survey field parties in the United States. One assistant professor from the university is now with the Survey for in-service training. One member of the staff is brought to the Survey each year for training.

Central America.—A report on the mineral deposits of Central America, now nearing completion, will summarize existing geologic information on this region.

Chile.—Cooperative studies in Chile began in 1943 and have resulted in two reports on the mercury and tungsten deposits, which are now awaiting publication by the Geological Survey. During the period 1946–48 an investigation of underground water supplies was made and recommendations for the development of ground-water resources were submitted to the Chilean Government. As a result of that work, the Chilean Government has organized a ground-water service and will continue studies of water supply. The first woman to be graduated as a mining engineer in Chile came to the United States in 1946 to study micropaleontology in preparation for work in subsurface correlation in the new petroleum field of southern Chile. She completed her studies in late 1947 and is now working on that problem.

Colombia.—A study of the mineral deposits of Colombia, other than petroleum, was completed during 1948 and the report will be published in the near future.

Costa Rica.—A report on the manganese deposits in Costa Rica (Bull. 935–H, 1944) reports the results of work done there by a Survey geologist in 1942. No cooperative geological investigations are being conducted at the present time.

Cuba.—Work in Cuba began in 1940 with the assignment of two geologists to study chromite and manganese. Between 1941 and 1945, 15 Survey geologists took part in this cooperative program.

The chromite deposits of Camagüey and Oriente were mapped in detail and a large-scale geologic map of the Camagüey chromite district was prepared. These detailed geologic studies, together with a new application of the use of the gravimeter, resulted in the discovery of new ore bodies. The known ore reserves are larger now than before World War II. The results of these studies on the chromite resources of Cuba were published in 1942 as Bulletin 935–A. Bulletin 954–B, on the geology and chromite deposits of the Camagüey District, is now being published. This will also be published in Spanish by the Dirección de Montes, Minas, y Aguas of the Cuban Ministry of Agriculture. A third bulletin on these deposits in Oriente is nearing completion.

Similar studies on the manganese deposits of Oriente have resulted in the following reports: manganese deposits of Cuba (Bull. 935–B, 1942), in the Guisa-Los Negros area, Oriente Province (Bull. 935–G, 1944), and in part of the Sierra Maestra (Bull. 935–F, 1944). Two additional reports are now nearly completed. Tungsten deposits on the Isla de Pinos were described in Bulletin 935–D, 1944. A number of scientific papers on other aspects of Cuban geology that have been published in the transactions of the American Geophysical Union and in other journals were byproducts of the cooperative work on ore deposits. No cooperative field work was conducted during 1948.

Jesús Francisco de Albear, now in charge of geologic mapping for the Dirección de Montes, Minas, y Aguas, was the first Latin American to receive the Geological Survey's certificate of award for completing in-service training with Survey field parties in the United States.

Dominican Republic.—Cooperative surveys of mineral deposits in the Dominican Republic were undertaken in 1941. A geological reconnaissance of the Dominican Republic with reference to the mineral deposits and studies on the geology and mineral resources of the Miamou-Hatillo District have been completed and the reports are now ready for publication. No cooperative field work was undertaken during 1948. Aluminous lateritic soils of the Sierra de Bahoruco area (Bull. 953–C) has been published.

Eduador.—In 1947 a Survey geologist made a reconnaissance study of the volcano Sangay on the east flank of the Andes, the results of which will be reported in an early issue of the National Geographic Magazine. A young Ecuadorean geologist has completed his in-service training with the Geological Survey and returned to take charge of the mining department of the Ecuadorean Government.

Haiti.—The studies of the mineral deposits of Haiti, begun in 1941 and completed in 1943, provided reports on the aluminous lateritic soils of Haiti (Bull. 954–C, 1947) and manganese deposits of the Republic of Haiti (Bull. 953–B, 1947). One Survey ground-water geologist is now conducting a ground-water survey of Haiti under the direction of the Institute of Inter-American Affairs in connection with the Food Supply program.

Mexico.—Field work began in Mexico in 1940 and has been carried on continuously to the present time. Twenty Survey geologists have taken part in collaborative field studies with an equal number of Mexican geologists. Among the mineral deposits studied are antimony, barite, coal, copper, fluorite, lead, manganese, mercury, optical calcite, tin, tungsten, and zinc. Emphasis at the present time is placed on geologic investigations of copper, and lead-zinc deposits. The following list of published reports will give some index of the Mexican work: Tin deposits of Mexico (Bull. 935–C, 1942); quicksilver-antimony deposits of Huitzuco, Guerrero (Bull. 946–B, 1945); scheelite deposits in the northern part of the Sierra de Juarez, Lower California (Bull. 946–C, 1945); tungsten deposits of the southern part of

Sonora (Bull. 946–D, 1945); San José antimony mines near Wadley, San Luis Potosí (Bull. 946–E, 1946); Geology of the Cuarenta mercury district, Durango (Bull. 946–F, 1946); and antimony deposits of the Tejocotes Region, Oaxaca (Bull. 953–A, 1947). Twenty-four additional reports of the Mexican work are now in process of preparation for publication by the Geological Survey.

The Geological Survey is in continuous cooperation with the Instituto de Geologia of the National University of Mexico, and this organization is publishing the cooperative reports in Spanish. The geologic cooperation extends beyond the study of mineral deposits to include such purely scientific work as daily observations on the new volcano Paricutin. A 5-year report is now being prepared which summarizes the volcano's life history since its birth February 20, 1943.

The Comité Directivo para la Investigación de los Recursos Minerales de México was organized in 1944, one of its objectives being to publish Spanish editions of the cooperative studies under this program.

Six young Mexican geologists have completed their in-service training with the Geological Survey's field parties in the United States. All of them are now working with cooperative parties in Mexico or on Mexican projects which follow methods learned in the United States. Two geologists are now receiving in-service training with the Geological Survey.

Peru.—The first work in Peru, in cooperation with the Instituto Geologico del Peru, was undertaken in 1946 and is continuing with major emphasis on lead-zinc deposit investigations. The report, Geology of the Huancavelica quicksilver district, is being prepared for publication in English and Spanish. In 1947 a study of the lead, zinc, and copper mineralization in the Cordillera Negra, Ancachs, was started by two Survey geologists working with Peruvian colleagues. During the field season 10 geologists from the engineering school in Lima had periods of field training with the party. Two young Peruvians, specializing in petroleum geology, spent a year (1946–47) with Geological Survey field parties in the United States. One of them is spending an additional year in the United States and will complete his master's degree at Stanford University in September 1948.

From 1940 through 1948 approximately $850,000 has been spent by the United States Government on cooperative geologic projects with the other American Republics. As the program continues, cooperation from the Republics is increasing through their contribution both of funds and of trained personnel.

GEOLOGIC MAPS

The Washington office of the Section of Geologic Cartography together with three of its units operating in Denver, Salt Lake City, and Spokane prepared during the year 718 geologic maps, charts, diagrams, and other illustrations for multicolor and black and white reproduction. The following are representative: Multicolor construction materials maps of Nebraska, North Dakota, and Montana, a sand and gravel map of Nebraska, and a metallic mineral resources map of Missouri, all prepared as part of the Missouri River Basin program. Of these, three have been published and two were ready for the printer at the end of the year. Work on 9 geologic quadrangle maps of the coast ranges in California and an accompanying plate of 26 structure sections was completed and delivered to the contractor. Multicolor geologic map indexes of the States of Wyoming, Nebraska, Colorado, Iowa, North Dakota, Kansas, Montana, South Dakota, Missouri, and Utah, comprising part of the new series, Index to Geologic Mapping in the United States, were prepared, and five of them were printed. Copy was prepared for the multicolor reproduction of the first four of the new series of Geologic Quadrangle Maps of the United States consisting of bedrock and surficial geologic maps of the Pawtucket (Rhode Island-Massachusetts) and the Mount Grace (Massachusetts-New Hampshire) quadrangles. Preparatory work was in progress on a number of other maps of the series and on a new geologic map of Montana. A two-color map showing possible sources of riprap in parts of North Dakota and South Dakota was prepared and printed, as well as a number of detailed illustrations to accompany a report on Michigan copper investigations. A multicolor geologic map of the Kerby, Oreg., quadrangle was completed and delivered to the contractor. Among other maps of more than usual interest completed or nearly completed during the year were the regional geologic maps of parts of Culberson and Hudspeth Counties, Tex., to be printed in four colors; a geologic map showing construction materials of Phillips and Jewell Counties, Kans.; the geologic map of Naval Oil Shale Reserves 1 and 3, Garfield County, Colo.; a map showing the geology and oil and gas possibilities of the Glendo area of eastern Wyoming; and a series of maps for the report on the magnetic survey and geology of the Ice Lake-Chicagon Creek area, Iron County, Mich.

The geologic map editor, in addition to critically reviewing the geologic maps, charts, and diagrams prepared in the Section of Geologic Cartography, edited 209 maps and figures prepared in the Section of Illustrations for professional papers and bulletins; 33 maps, figures, and charts prepared for water supply papers; 99 maps and figures drafted in field and section offices for outside publication; and 71 maps and figures planned for Survey publication but not yet drafted. The geologic map of South Dakota was edited and sent to the Division of Map Reproduction for engraving.

During the year, a new revised list of map symbols for use in Survey publications was prepared and printed by the end of June for general distribution to Survey and other geologists. Also a new rock-color chart for field use was prepared in cooperation with other geologic organizations and was expected to be ready for distribution by the end of July.

LIBRARY

The fiscal year 1948 was marked by a large increase in the use of the Geological Survey library. Accessions of 21,456 pieces exceeded the 1939 peak, and 13,000 readers used the library. Loans for use outside the library (including interlibrary loans), reading room circulation, and books used for bibliographic compilation resulted in a total use of over 83,000 books.

Despite several vacancies and the difficulties of obtaining qualified personnel, a large volume of work has been handled by the present library staff.

Plans were made for branch libraries to be located in Denver, San Francisco, and perhaps Spokane. These branches will provide library facilities and research material to men in the field, relieving the library in Washington of the necessity of sending a great volume of material to the field. A small special library of about 400 volumes was established in the Survey laboratory at the Naval Gun Factory.

The volume of material from foreign exchanges has increased, yet it has not reached the prewar volume. The Survey's own foreign exchanges are again being sent through the Smithsonian Foreign Exchange to most of the countries on the prewar list. Exceptions are Rumania, Bulgaria, and Yugoslavia. Exchange with Russian organizations through the central exchange agency for Russia, the Lenin State Library, has failed to produce any material. No more Survey publications will be sent until shipments from Russia are resumed. The Geological Society of America has undertaken to microfilm all Russian material needed by the Survey that is in the Library of Congress, as a service to American geologists.

The Heringen collection has been a valuable source of much-needed material published during the war in Russia, Germany, and other central European countries. Lack of personnel for cataloging and lack of space have prevented its rapid incorporation into the library. However, all but about 20 cases of the collection have been received from the Army Map Service.

Binding has not kept abreast of current needs and less than a thousand volumes were bound during the year. Rising costs used up the $6,000 allotment, leaving more than half of the library's binding work incomplete.

The Librarian represented the Geological Survey on the Inter-Agency Map Procurement Coordination Committee set up under the Central Intelligence Agency and the Department of State for the procurement of foreign maps for Government use.

The Bibliography of North American Geology, 1946–47, was completed and sent to the printer in June.

Topographic Branch

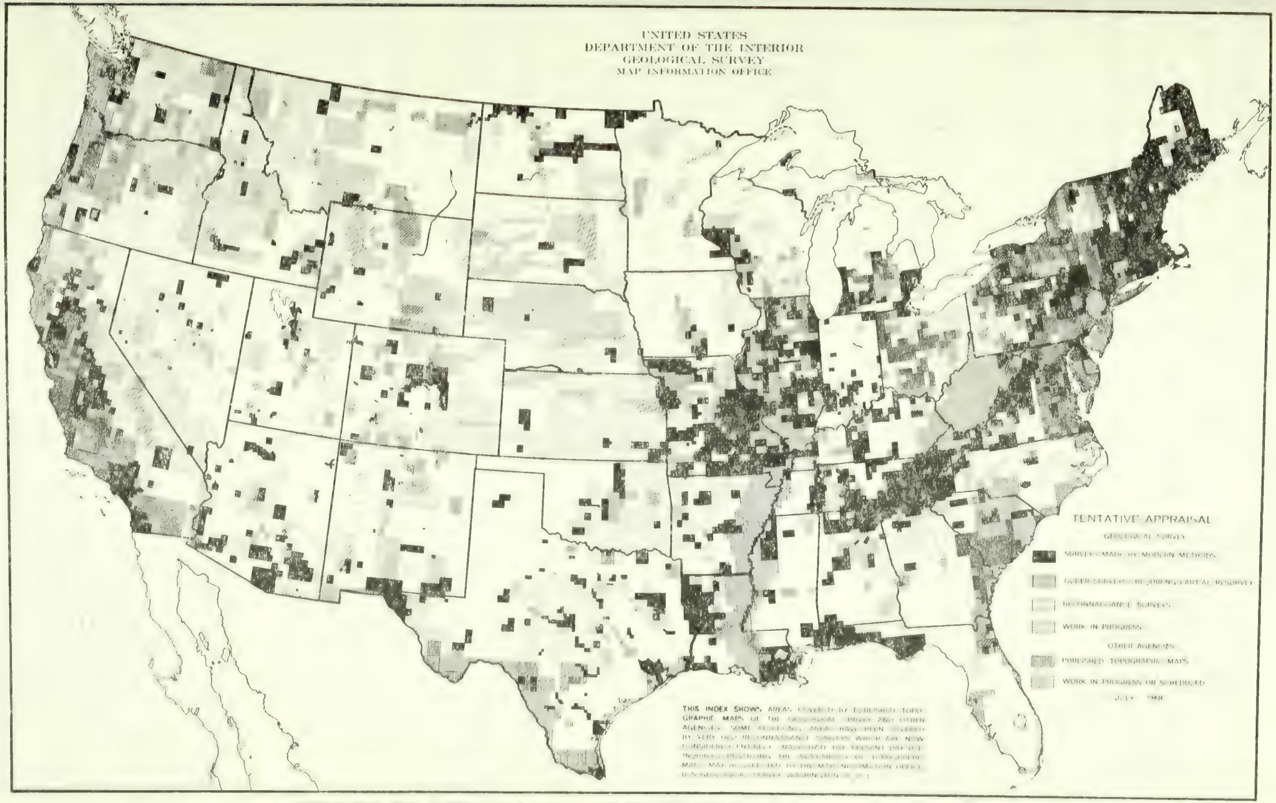
Topographic maps are well recognized as of great importance in the conservation and development of our natural resources, in the expansion of our basic industries, and to our national security and our economic welfare, to name a few purposes. Supplying this topographic information is a long, tedious process, but with the modern methods and increased production afforded through the use of aerial photography the Geological Survey has produced more maps during the past year than in any corresponding period in its history.

The demand by Government and State agencies, as well as by private concerns, for modern topographic maps continues in volume. To meet these needs a program for completion of the topographic map of the entire United States during the next 20 years has been prepared. The execution of this program is dependent upon adequate funds.

An inspection of the accompanying index map showing the status of topographic mapping in the United States reveals that nearly half of the domain has been mapped. However, a closer analysis reveals that less than 25 percent is covered by maps adequate for present-day requirements.

The interest in river-basin studies has been so intensified in recent years that it has become essential that all the Federal agencies operating within a basin coordinate their programs to assure the accomplishment of our common goal—the full development of our natural resources.

An important step toward the accomplishment of this purpose was taken at the Central Division Topographic Branch Conference held at Rolla, Mo., November 10–12 by representatives of State and Federal agencies interested primarily in the development of the Missouri River Basin. This conference afforded to officials of the Federal and State agencies an opportunity to discuss their mutual problems; and also, for the first time in the history of the Topographic Branch, it gave to the field and office personnel a full chance to exchange helpful views on the technical problems involved in the real objective, down-to-earth mapping. It was generally agreed that the conference was beneficial and that similar conferences should be held at regular intervals, not only in Rolla but at other division headquarters.


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MAP INFORMATION OFFICE
TENTATIVE APPRAISAL
GEOLOGICAL SURVEY
SURVEYS MADE BY MODERN METHODS
OLDER SURVEYS REQUIRING PARTIAL RESURVEY
RECONNAISSANCE SURVEYS
WORK IN PROGRESS
OTHER AGENCIES
PUBLISHED TOPOGRAPHIC MAPS
WORK IN PROGRESS OR SCHEDULED
JULY 1948

THIS INDEX SHOWS AREAS COVERED BY PUBLISHED TOPOGRAPHIC MAPS OF THE GEOLOGICAL SURVEY AND OTHER AGENCIES. SOME ADDITIONAL AREAS HAVE BEEN COVERED BY VERY OLD RECONNAISSANCE SURVEYS WHICH ARE NOW CONSIDERED ENTIRELY INADEQUATE FOR PRESENT DAY USE. INQUIRIES REGARDING THE AVAILABILITY OF TOPOGRAPHIC MAPS MAY BE ADDRESSED TO THE MAP INFORMATION OFFICE, U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.

STATUS OF TOPOGRAPHIC MAPPING IN THE UNITED STATES.

STATUS OF TOPOGRAPHIC MAPPING IN THE UNITED STATES

GEODETIC CONTROL SURVEYS

The new Geodesy and Control Surveys Section has nearly completed the separation of the functions inherited from the former Section of Computing. Considerable progress has been made in the new duties, as well as in the older functions, now assigned to this reorganized section, including the preparation of technical instruction manuals, research in new control survey methods, inspection of current control survey projects, and the collection of information and ideas from all available sources for possible application in control for mapping, and the development of the more promising ideas.

Manuals of instructions for supplemental control surveys, for spirit leveling, and for altimeter surveys have been prepared and reproduced for use in the Geological Survey.

Development of the electrical survey net adjuster was completed, and this device is now used for routine adjustments of nets of leveling and transit traverse surveys. A new vacuum chamber has been purchased, and it is possible now to calibrate the precise altimeters in sets of six to obtain more accurate results in the surveys made with these instruments. Extensive field tests have been made with two new instruments that measure elevation continuously as they are carried by automobile or trailer over roads and highways at 15 or 20 miles an hour; these instruments, designed by commercial organizations, integrate the effect of slope and distance and do not depend upon barometric pressure. General development in the use of shoran and other electronic methods of position determination is being closely watched in the belief that such methods may soon be applied to establish horizontal control for mapping.

Several inspection trips have been made to observe new control survey methods developed in the field, and to note in current operations the degree of compliance with adopted technical instructions and specifications.

PHOTOGRAMMETRY

The Section of Photogrammetry has four primary responsibilities—research and development of photogrammetric instruments and equipment; the proper distribution and installation of this equipment; the investigation of methods and the formulation of techniques and procedures; and the procurement of aerial photography, which includes the preparation of specifications, administration of contracts, and inspection of materials.

Nearly all of the captured German equipment that was turned over to the Survey has been evaluated and repaired. Most of this equipment is now in actual use. Several new designs for plotting instruments were prepared and new adaptations and combinations of photogrammetric equipment and technique have been used to form the basis of more accurate plotting instruments. One of the newly designed instruments, the Kelsh plotter, has successfully passed performance tests and units are being used as fast as they can be manufactured. Another plotting instrument, Twinplex, was designed up to the point of manufacture. Both of these instruments are intended to fill a definite need in the Topographic Branch. A German experimental plotter, Pagra, has been completed to the point of final assembly.

One piece of captured equipment, a near distortion-free lens, which has been placed with the United States Air Force for a development contract, has been reported on. The lens is to be made of American glass and the prospects are most encouraging. The successful production of such a lens will have a marked influence on all mapping activities of the Topographic Branch.

All equipment, both domestic and foreign, is being investigated in order to insure the greatest development and usefulness to the Survey's program.

Approximately 35,000 square miles of new photography was contracted for during the year. Photographs of approximately 50,000 square miles were delivered during the year, which includes final delivery of some contracts placed in previous years.

TOPOGRAPHIC SURVEYS

Work has continued throughout the year on the preparation of new or revised instructions in order to standardize the procedures and products of the four field divisions. A member of the section has also participated in the discussions of a joint committee composed of representatives of the principal mapping agencies of the Federal Government. The purpose of this committee is to prepare recommendations for the standardization of all information appearing on topographic maps of the United States. When changes were required in mapping procedures, new instructions were issued.

Instructions for field completion surveys have been issued in final form, also technical memoranda covering the showing of buildings and urban areas, hydrographic features, railroads, names, bridges, civil boundaries, woodland, contour intervals and supplementary contours, and miscellaneous landmark features. Technical memoranda on road classification and a field symbol sheet have been revised and reissued. Bulletin 788–E, Topographic Instructions, issued in 1928, and all technical memoranda issued prior to 1947 have been reviewed and appraised, and a supplement has been issued showing the status of all items covered.

A new stadia reduction table and a field note book for supplemental control surveys were devised and issued for field use.

One member of the section has served as chairman of a standing committee to evaluate and classify a large number of domestic maps, made for the Department of the Army during World War II and now turned over to the Geological Survey for distribution and for reprinting when required.

SPECIAL MAP PROJECTS

The Special Map Projects Section is concerned with the compilation of State, sectional, and regional maps at scales of 1:250,000, 1:500,000, 1:1,000,000, or smaller.

Work on the International Map of the World on a scale of 1:1,000,000 was continued by this Section. Four sheets were in course of preparation: Savannah (I–17), Los Angeles (I–11), Blue Ridge (J–17), and St. Augustine (H–17). At the end of the year, eight sheets had been transmitted for, or were in process of, publication: Hatteras (I–18), Chicago (K–16), Lake Erie (K–17), Cascade Range (L–10), Mount Shasta (K–10), Austin (H–14), Mississippi Delta (H–17), and Savannah (I–17).

Preparation of transportation maps for the Public Roads Administration was continued. Compiling, inking, lettering, and editing were in progress for the States of Ohio, Nevada, Alabama, Indiana, Missouri, Mississippi, and also revision of Louisiana. Six sheets of Ohio and 15 sheets of Nevada were transmitted for reproduction. Five sheets in West Virginia, eight sheets in Virginia, and one sheet of Washington, D. C., and vicinity are in various stages of reproduction. The remaining 10 of 33 sheets designed for Texas and 8 sheets for North Carolina were published.

Compiling, inking, lettering, and editing were in progress during the year on the revision of State base maps, scale 1:500,000, for Wyoming, New Jersey, Massachusetts, Rhode Island, and Connecticut, Maryland and Delaware, Illinois, Iowa, Oklahoma, and Indiana.

Compilation was started on a single-sheet topographic map of Puerto Rico for publication on the scale of 1:120,000. Several other special maps were also prepared by this Section during the year.

SECTION OF CARTOGRAPHY AND MAP EDITING

Cartographic procedures.—The Section of Cartography and Map Editing has two broad responsibilities: (1) Technical control of all cartography in regard to map-finishing procedures and determinations of style, symbolization, and quality of the end product, and (2) operational charge of editing and proofreading of all topographic maps.

During the year, the standardization of map treatment, lettering style, and symbolization were concluded insofar as present operational requirements are concerned. These projects were of a collaborative nature, as other interested mapping agencies were represented. No radical departures from past conventions were adopted, the conferees' objectives being those of clarifying items of inconsistent or confused treatment and reconciling any divergent viewpoints held by the several map-producing agencies. Research projects for improved drawing materials, map-lettering types, "stick-up" patterns and symbols to conserve drafting time are under way as long-range activities.

Map editing.—In accordance with reorganization plans, all possible production steps are to be performed in the field offices. During the year, drafting of miscellaneous features and map lettering, heretofore accomplished in Washington as a part of map editing, was assigned to the field offices. The Washington office editing is now one of general review and policy, which can be handled in a single phase manner. This will serve to reduce the dormant time that accrued in the past when several operations were involved. It will also enable the present staff to clear the greatly increasing number of maps that are to be reproduced. The past year was one of transition, insofar as changing procedures and work load are concerned. The number of maps scheduled for publication during the coming year is more than twice that of the past year and three times the average of the several preceding years.

During the past year 240 maps were edited for publication, of which 226 were for multicolor photolithography and 14 for engraving; 377 quadrangle maps, 13 State maps, and 13 State index maps were prepared and edited for reprint editions; 115 maps and diagrams that had been prepared as illustrations for geologic reports were edited; and 314 proofs of all kinds were read. At the end of the year, maps in process of reproduction included 27 for engraving and 65 for multicolor photolithography; maps being edited or awaiting editing included 6 maps for engraving and 88 for multicolor photolithography; and 507 maps remained on hand for preparation for reprinting.

PLANS AND ESTIMATES

The 1948 fiscal year marked a high point in operations for the Topographic Branch. In addition to the regular appropriation for topographic surveys, there was a substantial carry-over in funds allotted from the Bureau of Reclamation for Missouri River Basin mapping, as well as the new allotment. A large carry-over in an Army working fund set up in the fiscal year 1946 by the Department of the Army, Corps of Engineers, plus a new transfer from that agency, was used for mapping Army camps and military reservations.

The problem of shifting and arranging the work program so that expenditures could be brought to a proper balance on June 30 constituted a considerable part of the routine work of the Plans and Estimates Section. In addition, the section performed the usual work of assembling data on annual mapping requests of other agencies; budget preparation, long-range planning, and procurement of equipment and proper laboratory facilities for the operating Divisions.

The Pacific Division office, at Sacramento, California, was increased by the rental of approximately 14,000 square feet of laboratory space, especially constructed for the Branch, with plans made for an increase of 16,000 square feet, the total constituting fulfillment of that Division's need for space. Plans for the rental of a new building at the Central Division office, at Rolla, Mo., were completed, with construction scheduled for the fiscal year 1949.

The capacity of the Rocky Mountain Division office, at the Denver Federal Center, was increased by the installation of additional equipment and the transfer of personnel from the Central and Atlantic Divisions and the employment of new personnel.

Cooperation with States showed a general increase, the largest mapping programs being in California, Missouri, Illinois, Indiana, and New York. North Carolina increased its cooperation by starting a program of mapping along the principal routes for new highways. Nevada resumed cooperation for the 1948–49 biennium after a lapse of several years. The city of Bremerton, Wash., also entered into a cooperative agreement for mapping a special area in that vicinity. General State interest in mapping continued at a very high stage.

The importance of Alaskan operations was recognized by planning a comprehensive program and arranging allotments to put that program into operation. In order to expedite the movement of field parties in Alaska, contracts were let for the use of two helicopters, with pilots and maintenance crews, to operate in the Fairbanks and Juneau areas. The decision to use helicopters in Alaska was based on a test, conducted earlier in the year, in the vicinity of Denver, Colo.

The program of mapping Army camps, posts, and stations under the 1946 Army Working Fund was successfully concluded. Close contact was maintained throughout the year with the Chief of Engineer's office and the Army Map Service on that project in order to eliminate any possibility of duplication of effort and to coordinate the details of the work program.

MAP INFORMATION OFFICE

The growth of the Map Information Office as a service unit supplying information regarding maps, aerial photographs, and control surveys to the Geological Survey, other Federal and State agencies, and the public, has somewhat exceeded expectations. The popularity and value of the office may well be judged by the volume of correspondence which increased from 3,950 pieces of mail in 1947 to 9,252 in 1948. Among the principal users of this service have been engineers and geologists in highway planning and oil research.

Significant also were the requests for technical data for administrative and planning purposes in connection with drainage, flood control, irrigation, water supply, hydroelectric, television and radio broadcasting, and transportation projects. Numerous requests were also received from educational institutions for mapping and surveying data and for general information regarding mapping to be included in bulletins, papers, technical journals, and news releases.

The response to a newly adopted policy in supplying copy of map manuscript data to interested persons has been most gratifying. This policy enables one, where justified, to obtain the necessary map data well in advance of publication.

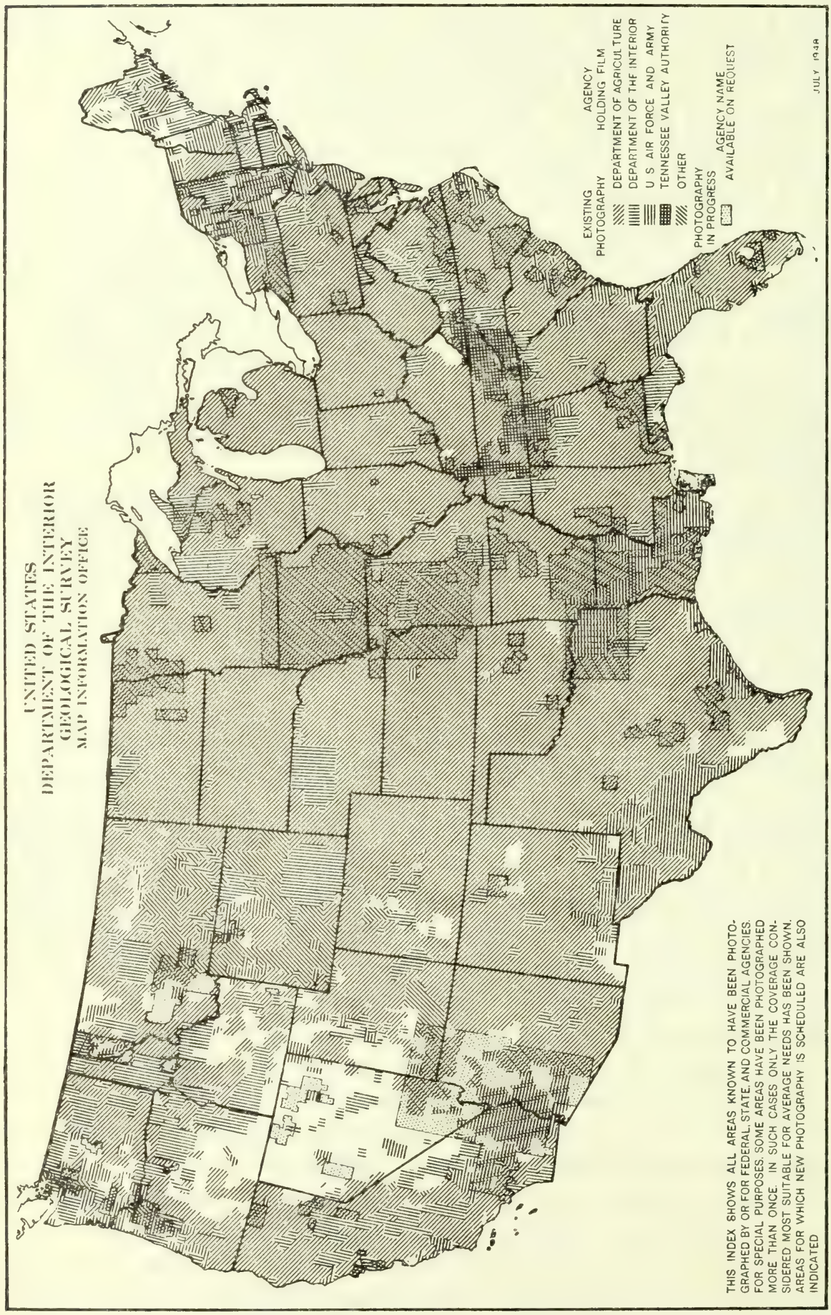
The third edition of an index showing the status of mapping in the United States and its territories and possessions was completed and printed. The number of maps in this edition was the largest ever printed by the Geological Survey for free distribution. Work was in progress on the fourth edition of this map which will continue to evaluate and to show mapping by the Geological Survey as well as other agencies.

The third edition of an index map was published showing the status of aerial photography in the United States by Government agencies and commercial firms for which photography is reported to date. Ten master base maps were completed, one for each of 9 Government agencies concerned, the other for aerial survey firms who regularly procure aerial photographs. These maps show the date of photography, focal length of lens, scale, and extent of coverage pertaining to the photographic holdings of the 10 organizations. This series represents an inventory of aerial photography of the United States.

Also published was an index map showing the status of aerial mosaics prepared by the various Government agencies, with information as to scale and date of the photography.

Orders for aerial photographic prints during the year increased nearly three times, amounting to a total of $24,326.55.

Of considerable interest to those having need for control data are the two index maps completed and prepared for publication. One index shows the status of horizontal control and the other shows the status of vertical control in the United States by the Geological Survey and other agencies. These indexes will fill a long-felt need for data of this type.


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MAP INFORMATION OFFICE
EXISTING PHOTOGRAPHY
AGENCY HOLDING FILM
▨ DEPARTMENT OF AGRICULTURE
▥ DEPARTMENT OF THE INTERIOR
▥ U S AIR FORCE AND ARMY
▦ TENNESSEE VALLEY AUTHORITY
▨ OTHER
PHOTOGRAPHY IN PROGRESS
▒ AGENCY NAME AVAILABLE ON REQUEST
JULY 1948
THIS INDEX SHOWS ALL AREAS KNOWN TO HAVE BEEN PHOTOGRAPHED BY OR FOR FEDERAL, STATE, AND COMMERCIAL AGENCIES. FOR SPECIAL PURPOSES, SOME AREAS HAVE BEEN PHOTOGRAPHED MORE THAN ONCE. IN SUCH CASES ONLY THE COVERAGE CONSIDERED MOST SUITABLE FOR AVERAGE NEEDS HAS BEEN SHOWN. AREAS FOR WHICH NEW PHOTOGRAPHY IS SCHEDULED ARE ALSO INDICATED

STATUS OF AERIAL PHOTOGRAPHY IN THE UNITED STATES.

STATUS OF AERIAL PHOTOGRAPHY IN THE UNITED STATES

As a most necessary activity, records of new mapping, geodetic surveys, aerial photography, and mosaic projects are currently added to the cumulative indexes. Before new work is undertaken, other agencies require that a check be made with the Map Information Office to avoid the overlapping and duplication of aerial photography, surveying, and mapping projects.

During the year the Geological Survey completed and received the training film "Topographic Mapping by Photogrammetric Methods," and a copy of the film has been sent to each Division office for showing before interested groups. The film has been loaned to more than 60 organizations. It has been most favorably received.

Several requests for maps, aerial photographs, and related material for display purposes were received, foremost of which were the Pan American Institute of Cartography and History at Buenos Aires; the International Geographical Congress at Lisbon, Portugal; the International Society of Photogrammetry, The Hague, Holland; and the American Society of Photogrammetry, Washington, D. C. Continuing interest is shown by foreign engineers in Geological Survey methods of mapping. During the year the Geological Survey was host to visitors from China, Siam, India, New Zealand, New South Wales, Switzerland, France, Holland, Turkey, Liberia, Argentina, Brazil, Ecuador, Chile, Mexico, and Canada.

TRIMETROGON MAPPING

The Trimetrogon Section has continued mapping and charting by the trimetrogon method for the United States Air Force. This method, developed at the beginning of World War II by the Geological Survey in cooperation with the Air Force, has been so satisfactory that several million square miles of planimetric and topographic charting has been accomplished in areas which previously were either inadequately mapped or entirely uncharted. The work is done on a reimbursable basis for the United States Air Force's Aeronautical Chart Service.

The over-all program, of which this work forms a part, is one of maintenance of adequate world coverage of aeronautical charts, primarily in the interest of national defense. It calls for a periodic review of all existing aeronautical charts with a view to progressive revision or recompilation of those charts which current world affairs indicate are pertinent.

The development of new weapons and new military strategy requirements has demanded greater precision than heretofore in the current charting program.

While chart priorities are established by the United States Air Force, as are the detailed specifications and other technical requirements, the Geological Survey conducts the editorial review and evaluation of assigned charts, makes observations and recommendations pertinent to their validity and, upon request, prepares by photogrammetric means, revised or recompiled base charts preliminary to photolithographic reproduction. A complete and detailed compilation history is prepared for each chart reviewed, showing the original source of information used and its evaluation.

In addition, the Section maintains the only existing world-wide reference library of trimetrogon photographs. This library contains several million oblique and vertical photographic prints, from which is obtained the basic information for its own charting work as well as for reference by other organizations whose interests may be in geology, forestry, water resources, construction, national defense, or engineering development.

During the year the Section completed more than 700,000 square miles of entirely new compilation, all of which was subjected to rigid inspection in the photo-topographic unit, where appropriate contouring was added; it also revised nearly 800,000 square miles of charts and more than 450,000 square miles of cartographic compilation, making a total of more than 1,900,000 square miles. This charting covered areas in practically every part of the world and may be summarized as follows:

Preliminary charts at scales 1: 500,000 and 1: 250,000 (foreign)	179
World aeronautical charts at scale 1:1,000,000 (foreign)	32
Pilotage charts at scale 1: 500,000 (foreign)	8
Approach and landing charts at scale 1: 250,000 (foreign)	18
Photo-mosaics (foreign)	18
Special charts (domestic)	2

In addition, there are currently under way 225 similar charts in various stages of completion.

Coincident with the discharge of its major responsibility for mapping and charting, the Trimetrogon Section has also engaged in several special projects for other branches of the Geological Survey and the Department of the Army. These include a continuation of the microfilming of approximately 48,000 field note and computation record books of horizontal and vertical control data (35 percent completed); conception and demonstration of the feasibility of operating the Photo-alidade and Mahan plotter together in the successful photogrammetric compilation of large-scale topographic maps from rugged terrain, by completing a 100 square mile area, with 100 foot contours, at the scale of 1:31,680; and cooperative endeavor on the initial planning of small-scale map and photographic requirements for unmapped expanses in the Western United States.

Special photo-mosaics were prepared for use by the United States Navy Task Force 39, in their procurement of geographic control in Antarctica, and the compilation of Operation Highjump photography is now in progress.

Throughout the year, assigned research was carried on for the military and naval forces with a view to establishing limits of accuracy of present operations and evaluating the effectiveness of certain modifications in instruments and procedures.

MAPPING ACCOMPLISHMENTS

During the year, topographic mapping was carried on in 38 States and in Puerto Rico. Cooperative projects were conducted with 18 States and with the Tennessee Valley Authority.

The mapping of 45 15-minute quadrangles and 422 7½-minute quadrangles was completed, and mapping was in progress on 65 15-minute quadrangles and 194 7½-minute quadrangles. In addition, work on 1,401 quadrangles was progressing in one or more of the preliminary steps prior to actual mapping, including the revision of a large number of maps in the San Joaquin Valley, Calif.

Shaded relief maps of New Jersey, the District of Columbia, and Massachusetts-Rhode Island-Connecticut were completed. The mapping of Culebra Island, Puerto Rico, was completed for the Bureau of Yards and Docks, Department of the Navy.

For the Corps of Engineers, Department of the Army, mapping of Camp Croft, S. C., and Camp Erwin, Calif., was completed. Mapping was in progress at Camp Carson, Colo., Fort Leavenworth, Kans.-Mo., and Fort Francis E. Warren, Wyo. Basic control was completed at Aberdeen Proving Grounds, Md., A. P. Hill Military Reservation, Va., Camp Campbell, Ky.-Tenn., Camp Hood, Tex., and Fort Knox Extension No. 2, Ky. Mapping of the Joanna Reservoir Site, on Salt River, Mo., was begun.

For water power, flood control, and irrigation the mapping of the Snake River, Idaho, in the Columbia River Basin, was continued. As a part of the Missouri River Basin Development Program, extensive surveys were accomplished in North Dakota, Nebraska, Montana, and other areas within the Missouri River Basin.

In connection with geologic investigations for strategic minerals, mapping was completed or in progress in many States during the year.

State	Area (in square miles) mapped during fiscal year 1948 for publication at standard scales (contour intervals from 5 to 500 feet)						Amount of new mapping to June 30, 1948 (square miles)	Total area mapped to June 30, 1948 (square miles)	Percent complete
	1:24,000	1:31,680	1:62,500	New mapping	Remapping	Revision			
Alabama	788			186	602		26, 921	51, 609	52. 2
Arizona	562				562		35, 187	113, 909	30. 9
Arkansas			121	121			24, 881	53, 102	46. 8
California	3, 458		2, 420		5, 039	839	133, 076	158, 693	83. 9
Colorado	525				525		58, 363	104, 207	56. 0
Connecticut							5, 009	5, 009	100. 0
Delaware							2, 057	2, 057	100. 0
District of Columbia							69	69	100. 0
Florida	359				359		11, 949	58, 560	20. 4
Georgia							25, 202	58, 876	42. 8
Idaho	482		358	692	148		39, 236	83, 557	46. 9
Illinois	1, 360		2, 872	747	1, 101	2, 384	50. 910	56, 400	90. 3
Indiana	591			523	57	12	10, 413	36, 291	28. 6
Iowa							14, 233	56, 280	25. 3
Kansas	262		236		498		65, 852	82, 276	80. 0
Kentucky							27, 805	40, 395	68. 8
Louisiana			685	685			20, 110	48, 523	41. 4
Maine			82	82			26, 282	33, 215	79. 1
Maryland	622				622		10, 577	10, 577	100. 0
Massachusetts		431				431	8, 257	8, 257	100. 0
Michigan	840		226	226	840		18, 396	58, 216	31. 6
Minnesota							9, 576	84, 068	11. 4
Mississippi							10, 032	47, 716	21. 0
Missouri	1, 414		2, 709		3, 095	1, 028	64, 498	69, 674	92. 6
Montana	33			8	25		40, 097	147, 138	27. 3
Nebraska			223	223			29, 441	77, 237	38. 1
Nevada							44, 165	110, 540	40. 0
New Hampshire							9, 304	9, 304	100. 0
New Jersey							7, 836	7, 836	100. 0
New Mexico	250			124	126		36, 800	121, 666	30. 2
New York	477		1, 534		477	1, 534	49, 576	49, 576	100. 0
North Carolina							19, 764	52, 712	37. 5
North Dakota	1, 633		175	1, 808			20, 930	70, 665	29. 6
Ohio							41, 222	41, 222	100. 0
Oklahoma			138		138		41, 901	69, 919	59. 9
Oregon			214	214			37, 304	96, 981	38. 5
Pennsylvania	1, 049			436	613		45, 110	45, 333	99. 5
Rhode Island							1, 214	1, 214	100. 0
South Carolina	811			372	439		17, 098	31, 055	55. 1
South Dakota							20, 750	77. 047	26. 9
Tennessee	2, 251			2, 240	11		26, 778	42, 246	63. 4
Texas			1, 805	1, 173	632		95, 106	267, 339	35. 6
Utah	229			229			20. 501	84, 916	24. 1
Vermont							9, 365	9, 609	97. 5
Virginia			1, 270		1, 270		38, 097	40, 815	93. 3
Washington			663	63	600		44, 763	68, 192	65. 6
West Virginia	33		136		66	104	24, 181	24. 181	100. 0
Wisconsin			860	429	431		21, 453	[1] 56, 154	38. 2
Wyoming	618				618		36, 296	97, 914	37. 1
Total	18, 710	431	16, 727	10, 644	18, 894	6, 332	1, 477, 943	3, 022, 407	48. 9
Alaska			460	[2] 5, 950	69		274, 351	586, 400	46. 8
Hawaii							6, 435	6, 435	100. 0
Puerto Rico				[3] 16			3, 386	3, 435	98. 8

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[1] Planimetric maps covering 940.3 square miles in Wisconsin not included in total surveys.

[2] Includes 5,529 square miles mapped on a scale 1:250,000.

[3] Mapped on a scale of 1:30,000.

DISTRIBUTION

The Division of Distribution received during the year a total of 3,907 publications, comprising 47 new book reports and pamphlets and 1 reprint; 24 preliminary maps and charts in the oil and gas investigations and strategic minerals investigations series; 353 new or revised topographic and other maps (23 of which were first published as preliminary editions); 60 Tennessee Valley Authority maps with contours; 401 reprinted maps (topographic, advance sheets, indexes, and planimetric); and 3,021 Army maps turned over to the Geological Survey for distribution.

The total units received numbered 73,302 books and pamphlets (including reprints), 42,670 copies of revised index maps, and 5,195,012 topographic and other maps, a grand total of 5,310,984.

The Division distributed 104,928 books and pamphlets, 2,992 geologic folios, and 1,054,720 maps, a grand total of 1,162,640 of which 2,618 folios and 811,230 maps were sold.

The net proceeds from sales were $129,047.49 for maps and $1,422.60 for geologic folios. In addition, $23,969.63 was repaid by other Government agencies for maps or folios furnished. The total net receipts, therefore, were $154,439.72. Local sale of maps to private individuals increased from $6,753.46 to $6,827.55, which meant rendering service to 9,873 people. The Division handled 63,684 letters.

	On hand July 1, 1947	Received	Distributed	On hand June 30, 1948
Geologic folios	18, 899		2, 992	15, 907
Maps	11, 816, 648	5, 195, 012	1, 054, 720	15, 956, 940
Publications:				
Complete volumes	126, 334	41, 908	56, 751	111, 491
Separate chapters, extracts, and miscellaneous pamphlets	183, 764	31, 394	48, 177	166, 981
Total	12, 145, 645	5, 268, 314	1, 162, 640	16, 251, 319

FIELD EQUIPMENT

By far the major portion of the work of the Division of Field Equipment during the past year has been the repair and maintenance of the Survey's instruments. Although the Denver shop, established in 1946, has expanded and is now performing a considerable amount of basic instrument and equipment maintenance, the Washington instrument shop has had difficulty in devoting a quarter of its productiveness to the construction of special instruments and new developments.

New equipment acquired for the Washington shop during the past year includes a new engraving machine, a scale dividing engine, and an altimeter test chamber in which precise altimeters can be accurately calibrated in sets of six, as required for the two-base system of barometric leveling now in practice.

Two of the instrument makers are now experienced in repairing and adjusting the complex European type of optical-reading theodolites.

Four Wilson photo-alidades of an improved design, employing optical-reading theodolites, were constructed during the year. This new type, owing to its optical-reading feature, can be operated faster and more accurately than the previous model.

Construction is nearing completion of a larger and improved graph rectifier, which will convert the record chart from the airborne magnetometer to a graph form suitable for study and evaluation.

Detail drawings for a standard-angle Kelsh plotter have been completed, a plotter is on order, and development is progressing favorably on a wide-angle Kelsh plotter. This development will permit conversion of the medium-angle plotter to the wide-angle plotter and vice versa, with the change of very few parts, mainly the lens cone assembly.

Because of the scarcity of high-grade white-pine lumber and improvements in the production of magnesium, the light metal is being tried for such items as plane-table boards and surveying rods, 100 of the former now being in regular and satisfactory use. The first magnesium-invar precise leveling rods are now nearing completion.

The Columbus shop of the Water Resources Branch is being expanded and will undertake some of the badly needed development work which could not be done in the Washington shop because of lack of time and space.

Water Resources Branch

Water is the Nation's most important natural resource. It is a transient resource in that it cannot be conserved for the future simply by not using it. It is a renewable resource in that the amount of water in streams and underground is constantly being replenished through the operation of the hydrologic cycle. That cycle is the circulating system whereby water is transformed from the sea and the land to vapor in the air and then is precipitated back upon the earth, purified. The process is continuous, but because the rate varies from time to time and place to place the water supply in any one locality is always changing. Streams rise and fall; flood follows upon drought or flood in an irregular pattern; likewise the water levels in wells rise and fall and the quality of the water changes as it dissolves the rocks and picks up its load of sediment. Only by keeping records of these never-ending changes can we know what our water resources are. The collection and compilation of those records is the major work of the Water Resources Branch.

In the United States the supply of fresh water has been so abundant that until within the last hundred years it was considered essentially inexhaustible. The advance of civilization is accompanied by the steadily increasing use of water for its many activities. Our modern economy is creating demands for fresh water of a magnitude and variety which formerly were never dreamed of. Air-conditioning is a notable example. Our population is growing steadily and the per capita use of water is increasing by leaps and bounds—for domestic purposes, for irrigating farm and pasture, for countless industries, and for the continually arising new ways of using water that are associated with high living standards and growing industrial capacity. An example is the tremendous quantity of water that will be required in the manufacture of synthetic fuels to supplement our dwindling oil reserves. In most of our cities the per capita daily use of water far exceeds the 100 gallons that a generation ago was regarded as standard. In our present economy there is seemingly almost an insatiable demand for water as a raw material, as a processing agent, and as a medium of heat exchange or temperature control. In some parts of the country full utilization of the water supply seems so close that the level of social and economic development dependent upon water is already approaching a ceiling. In the arid regions there is a keen awareness of the critical place of water in determining further growth and it requires no prophet to see that the area where there is reason for concern is steadily expanding.

As the utilization of water supplies approaches the limit there is increasing need for up-to-date information on those supplies. This need is met in part by the Water Resources Review, a monthly press release by the Geological Survey giving current information about water supplies in the United States and Canada. The monthly release is supplemented by a semiannual summary of conditions, and that for the period October-to-March contains also a summary of snow surveys and status of water storage in reservoirs. In June 1948 a special supplement was issued describing the current floods in the Columbia River Basin.

FEDERAL GOVERNMENT'S INTEREST IN WATER RESOURCES

The problems of water supply and utilization affect such large areas and such wide interests that they are becoming more and more problems of National concern. Therefore the collection of information on water resources is often an obligation of the Federal Government with or without the cooperation of States and municipalities.

The Federal Government is also a large user of water-resources information. For example, in the Columbia and Missouri River Basins where great multiple-purpose dams are being built and operated, extensive and accurate water-resources information is essential to the economic design and operation of such projects. Likewise, the need for water supplies on the public domain for watering livestock requires continuing search to maintain adequate supplies for efficient grazing operations.

The Federal Power Commission requires licensees operating hydroelectric projects to measure the flow of streams used to generate power. At the request of the Commission the Geological Survey during 1948 supervised stream gaging on 129 licensed projects.

The magnitude of the interest of the Federal Government in water-resources information is shown by the $1,560,000 transferred during 1948 by other agencies to provide for investigations to be made by the Geological Survey that could not be financed within its own appropriation. Those agencies are the Bureau of Reclamation, Office of Land Utilization, Office of Indian Affairs, Fish and Wildlife Service, Virgin Islands, Bonneville Power Administration, and National Park Service, Department of the Interior; Corps of Engineers, Department of the Army; Department of the Navy; State Department; Weather Bureau, Department of Commerce; Soil Conservation Service and Forest Service, Department of Agriculture; Department of Justice; Tennessee Valley Authority; Atomic Energy Commission; Veterans' Administration; Federal Power Commission; Federal Works Agency; and Public Health Service, Federal Security Agency.

COOPERATION WITH STATES AND MUNICIPALITIES

The welfare of the Nation is dependent on agriculture and industry, and the welfare of agriculture and industry depends on adequate water supplies. The information on water supplies collected by the Geological Survey thus is available to and benefits all. For this reason the major part of the water investigations of the Geological Survey are made in cooperation with the States and municipalities. Many years of records are necessary for the economic planning of a specific project and therefore many of these investigations should be started well in advance. The operation of hydraulic and industrial plants, on the other hand, requires current information about the fluctuations in water supplies. An adequate record once collected and compiled may be of value for many and diverse uses.

As the limit of a supply is approached or reached, the demand for reliable up-to-date information becomes more insistent. That the importance of this work is recognized by State and local communities is shown in the way that funds offered by those agencies for cooperation with the Geological Survey have grown steadily and generally exceeded funds regularly appropriated to the Geological Survey for that purpose. The appropriation for cooperative work in 1948 was $2,071,500. The amounts available for cooperation in the fiscal year 1948 in each State are summarized below:

State	*Total available*	*State*	*Total available*
Alabama	$19, 495	Florida	$90, 151
Arizona	47, 448	Georgia	26, 400
Arkansas	27, 721	Idaho	41, 362
California	109, 345	Illinois	27, 833
Colorado	58, 849	Indiana	49, 345
Connecticut	15, 750	Iowa	39, 201
Delaware	3, 797	Kansas	35, 381

State	*Total available*
Kentucky	$28, 090
Louisiana	37, 983
Maine	8, 499
Maryland	41, 727
Massachusetts	36, 093
Michigan	59, 562
Minnesota	19, 458
Mississippi	11, 551
Missouri	23, 700
Montana	27, 098
Nebraska	31, 893
Nevada	24, 252
New Hampshire	11, 239
New Jersey	36, 406
New Mexico	67, 063
New York	128, 607
North Carolina	42, 433
North Dakota	26, 401
Ohio	72, 268
Oklahoma	$54, 028
Oregon	32, 067
Pennsylvania	86, 615
Rhode Island	4, 600
South Carolina	14, 373
South Dakota	1, 989
Tennessee	33, 718
Texas	158, 459
Utah	51, 971
Vermont	7, 260
Virginia	45, 403
Washington	72, 353
West Virginia	14, 778
Wisconsin	26, 149
Wyoming	33, 645
Hawaii	63, 100
Total	$2, 026, 909

TOTAL FUNDS AVAILABLE

Funds aggregating more than $6,700,000 were available for water investigations in the fiscal year 1948. Of that amount, about 47 percent was appropriated by Congress, 30 percent was contributed by States and municipalities, and about 30 percent was provided by other Federal agencies.

FIELD OFFICES

Water investigations can best be made through strategically located field offices, and in 1948 the work was conducted from more than 100 principal offices, with one or more in nearly every State and in the Territories of Alaska and Hawaii. This decentralization results in a high degree of efficiency and economy of work and in better service to the public. Close contacts are maintained with local, Federal, State, and municipal officials, and the interests of cooperating agencies are served. The Survey's field offices are local sources of information as to available water resources, fluctuating stage and discharge of surface streams, fluctuations in the ground-water table, and the chemical and physical quality of surface and ground waters.

Although the water-resources investigations are conducted along three lines—surface water, ground water, and quality of water—for administrative purposes and for reporting, the activities are so interrelated that only by giving comprehensive attention to all three can a balanced water-resource investigation be made.

SURFACE WATER

Recognition of the vital importance of surface-water supplies is shown by the steadily increasing demands from many sources for more information. This has been accompanied by increases in the amount of funds expended by States and municipalities for water-resource investigation in cooperation with the Geological Survey. At the end of the fiscal year 1948 there were in operation for measuring the flow and stage of surface streams and lakes about 6,000 gaging stations distributed throughout the States and in the Territories of Alaska and Hawaii. These gaging stations were operated through more than 60 field offices in cooperation with 166 agencies of States and political subdivisions and with several Federal agencies. The stream-gaging program in Alaska, which was begun in 1947 with the establishment of 7 gaging stations, was expanded to about 35 gaging stations during the fiscal year 1948; plans have been made for continued expansion of this program during the fiscal year 1949. Plans were completed for the expansion of laboratory and shop facilities for the development and improvement of equipment for the measurement of streams. The series of laboratory observations begun in 1947 on the effect of backwater on discharge of rivers was completed in 1948, and some progress was made in the analysis of the data and preparation of a report. A special-type snowmobile for winter observations in remote mountain areas, developed and constructed in cooperation with the Soil Conservation Service, Department of Agriculture, was tried out during the winter. Considerable progress was made on a program in close cooperation with the Public Roads Administration and various State highway departments to work out better procedures and promote better utilization of stream-flow records in the solution of hydraulic and hydrologic problems connected with highway structures. General plans were made for a report on the Columbia River flood of May and June 1948 to be prepared in the 1949 fiscal year.

GROUND WATER

Unlike surface water, ground water is nearly uniform in quality and temperature the year around. It bridges the gap between rains by maintaining the flow of streams in dry weather. The earth's underground reservoirs, in which ground water is stored, are exceedingly irregular and intricate in form but they can be accurately mapped and their structure can be determined. It is the purpose of ground-water investigations not only to define the areal location and extent of the underground reservoirs but to determine the amount of ground water that can be stored in and economically recovered from these reservoirs.

The methods employed in conducting ground-water investigations are varied, and considerable adaptation is required to fit the appropriate methods to the wide diversity of problems. In Arizona, for example, geophysical methods were successfully employed to locate adequate ground-water supplies in critical areas where previous efforts by private interests had been unsuccessful. In the Piedmont area of North Carolina statistical studies of the relation of the yields of wells to well depths, thicknesses of weathered zones, topography, and kind and condition of bedrock resulted in development of criteria for selection of well sites that are applicable over the entire Piedmont area from southern Pennsylvania to Alabama.

Ground-water investigational methods and equipment are continually being improved. A laboratory has been organized to permit analysis, through use of electrical models, of complicated ground-water flow problems that will have immediate application to many field projects. This knowledge will make possible more efficient utilization and development of our underground reservoirs and will provide a means for preventing overdraft in places where demands are heavily concentrated. Although in some localized areas ground-water reservoirs have been overdeveloped, causing spectacular declines in water-table elevations, this by no means indicates that the Nation is headed toward early exhaustion of its ground-water resources. Much is being accomplished by redistributing pumpage, applying artificial recharge, and using other means to preserve the usefulness of ground-water resources that have been overdeveloped locally. New ground-water reservoirs are still being located and developed as the field investigational programs expand, and many existing reservoirs now under observation are only in early stages of development.

During the 1948 fiscal year, ground-water investigations were being made on nearly 400 projects scattered through nearly every State, Hawaii, Puerto Rico, and Alaska. These activities were conducted through 35 district offices in financial cooperation with 77 State, county, and municipal agencies and with 8 Federal agencies.

Nearly 250 formal reports of various kinds were prepared and several thousand requests for information on ground-water conditions in all parts of the country were answered.

QUALITY OF WATER

Pure water does not exist in nature. Because water is a powerful solvent, every drop of rain water carries dissolved or suspended material—dust, pollen, and smoke as well as the atmospheric gases, oxygen, nitrogen, and carbon dioxide. When rain falls, the water running over the rocks and percolating through the soil gathers more and more mineral matter in solution. The mineral matter dissolved in the water or the sediment carried by it is of primary importance in determining the uses to which the available supplies may be put. Not infrequently a supply may be adequate with respect to quantity but wholly undesirable or even unusable when its quality is considered.

During the fiscal year 1948, 17,500 samples of water were analyzed for chemical quality in the central laboratory in Washington, D. C., and in the 11 field laboratories located over the country. These data, together with analyses made in previous years, provide a growing storehouse of factual information concerning the chemical composition of the Nation's water resources. Continuing records are invaluable in determining the changes in quality of streams and underground waters as a result of variations in climate, or the effects of agricultural development, industrial concentrations, and other activities of man. Cooperative investigations of the chemical quality of surface waters were in progress in Virginia, Georgia, North Carolina, South Carolina, Pennsylvania, Florida, Arkansas, Texas, Oklahoma, Ohio, Iowa, New Mexico, and Colorado. Samples were also analyzed for cooperative studies of ground water in those and other States. Two field laboratories were established during the year, one at Schuylkill Haven, Pa., and the other at Columbus, Ohio. The laboratory at Schuylkill Haven was set up to handle a portion of the State cooperative program in Pennsylvania. The Columbus laboratory is a regional laboratory designed to serve both Federal and State interests throughout the lower Ohio River Basin.

Factual data concerning the adequacy of the water supply for municipal or agricultural uses or with respect to corrosiveness or scale-forming properties of the waters are essential in sound development of Federal projects and the protection of Federally owned equipment or plants. Water samples were examined and analytical results, interpretation of analyses, or advice about water problems were furnished to the following Federal agencies: Bureau of Reclamation, Bureau of Mines, Fish and Wildlife Service, Department of the Navy, Veterans' Administration, Public Housing Administration, and Federal Works Agency. The Survey laboratories also regularly make analyses for the Department of the Army in connection with investigations of scale and corrosion problems, involving threshold treatment of water supplies at Army posts. During the past fiscal year 2,100 analyses were made at the request of the above-mentioned agencies, of which 450 were analyses of samples collected at Army ground and air installations in this country, and at off-shore installations.

The importance of measuring the large quantities of sediment transported by the rivers of this Nation is rapidly becoming more widely recognized. The demand for the construction of large dams to impound greater quantities of water in reservoirs for irrigation, power development, and industrial use has focused attention on the probable useful life of these reservoirs. As the greater part of the sediment carried in streams is dropped in the reservoirs, it is essential that systematic studies be made to determine the quantities of sediment that will have to be taken into account in the construction of the dams.

During the past year there has been a very substantial increase in the extent and scope of sediment-measurement activities of the Geological Survey. Sediment samples were collected daily or more frequently at 69 stations on streams in the Colorado, Rio Grande, Missouri, Washita (Okla.), Schuylkill (Pa.), and Brandywine (Del.) River Basins. In addition, miscellaneous sediment samples were collected on an intermittent basis at 72 stations in these river basins. In all, more than 80,000 sediment samples were collected and analyzed during the year in laboratories located at Albuquerque, N. Mex.; Lincoln, Nebr.; Worland, Wyo.; Norton, Kans.; Dickinson, N. Dak.; Stillwater, Okla.; and Schuylkill Haven and Philadelphia, Pa.

MISSOURI RIVER BASIN

The coordinated projects of the Bureau of Reclamation and the Corps of Engineers, Department of the Army, for the development of the Missouri River Basin require extensive water investigations in that basin. The investigational programs, conducted generally in cooperation with States and municipalities, are supplemented by 165 stream-gaging stations operated in the Departmental program; by studies, in the vicinity of 33 reclamation units, related to ground-water supplies or to changes in ground-water conditions that may result from reservoir construction or irrigation; by 40,200 measurements of the sediment content of surface waters at 48 regular stations and 12 stations for miscellaneous measurements; by 2,500 analyses of the chemical quality of the waters at 16 regular stations and at 63 stations for miscellaneous records; and by hydrologic and utilization studies related to the proposed plans of development. The information obtained through these investigations is furnished to the above agencies currently or periodically as may be desired.

INTERSTATE COMPACTS

Interstate compacts for division between States of waters of interstate streams, which require the Geological Survey to establish and operate gaging stations, are now in effect for Colorado River (Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada, California); Belle Fourche River (Wyoming, South Dakota); Republican River (Nebraska, Kansas); Rio Grande (Colorado, New Mexico, Texas); and Costilla Creek (Colorado, New Mexico). Similar compacts are in process of negotiation for Arkansas River (Colorado, Kansas) and Bear River (Idaho, Utah).

INTERNATIONAL TREATIES

International problems related to water are increasing. The Geological Survey, using funds transferred by the State Department, makes the water resources investigations along the Canadian boundary that are required by orders issued by the International Joint Commission, United States and Canada, under the treaty of January 11, 1909. In addition to these continuing investigations needed for division and control of waters along the international boundary, several special investigations were made in 1948 in connection with references before the Commission, particularly those relating to the Columbia River Basin, Sage Creek, Mont., Waterton and Belly Rivers, and Souris and Red Rivers. The Geological Survey, through agreement with the State Department, has continuing obligations for obtaining water resources information along the Mexican boundary as required by the Mexican Water Treaty of 1944. Members of the Geological Survey serve on several international engineering boards.

REPORTS ON INVESTIGATIONS

The results of the varied studies and computations made by the Water Resources Branch are made available for public inspection as soon as practicable by placing manuscript copies of observations, measurements, and analyses in the open files of the district offices concerned. The availability of this information is frequently announced through a press release. Stream-flow and ground-water conditions in the United States and Canada are summarized monthly and semiannually in the Water Resources Review.

The published work of the Water Resources Branch during the fiscal year 1948 consisted of 24 new water-supply papers and 5 reprints, a large number of shorter reports in the technical press, and 71 reports transmitted to cooperating State agencies for publication by them. In addition a number of miscellaneous processed reports were issued.

Conservation Branch

Under delegation of authority from the Director, the Conservation Branch classifies the public lands of the United States as to mineral and water resources, and under a delegation from the Secretary of the Interior it supervises mineral recovery operations under leases, permits, and licenses on public, acquired, Indian, and naval petroleum reserve lands. The Branch maintains a small headquarters staff in Washington and a field staff of competent geologists and engineers in strategic centers of mineral resource development. This investigative and supervisory force makes field surveys, prepares maps and reports dealing with water power, fuels, minerals, and chemicals essential to the mineral resource economy of the United States and conducts "on-site" supervision of mining and drilling methods essential to the economical and safe production of coal, oil, gas, and other minerals, all to the end that this Nation's mineral resources shall be developed and produced by private enterprise in accordance with approved methods and in compliance with accepted conservation practices under applicable Federal legislation.

MINERAL CLASSIFICATION

In continued response to the postwar demand for increased supplies of mineral fuels, fertilizer ingredients, basic chemicals, and fissionable source material from lands and deposits owned by the United States, all phases of the service rendered by the Mineral Classification Division in the administration of public and acquired lands were maintained at a greatly accelerated pace throughout 1948.

In all some 28,926 cases involving either the outright disposal of Federal lands with no reservation of any mineral; the disposal of such lands with the reservation of one or more specified minerals to the United States; or the exercise under the Federal leasing laws of the Government's right to explore for and produce one or another mineral substance from lands under its immediate jurisdiction, were acted on during the year. This represents an increase of some 76 percent in the service demands on the division with no concurrent increase in its funds or personnel. Initial or revised definitions of the known geologic structure of 12 producing oil or gas fields containing Federal lands were prepared and promulgated; geologic appraisal was made of 90 unit-plan or participating-area submissions; and about 238 special reports were prepared for departmental agencies and others concerned, on new discoveries of oil or gas on or affecting Federal lands, and on applications for the determination of leasehold relations to the limits of producing oil and gas deposits as known on August 8, 1946, pursuant to sections 4 and 12 of the act approved on that date (60 Stat. 950).

In addition, the division prepared for a variety of departmental and extra-departmental agencies concerned with the disposal of acquired Federal lands, determinations of the potentialities for fissionable source material of no less than 3,715 land parcels in practically every State, Territory, and possession of the United States, pursuant to Executive Order 9701 of March 4, 1946, and to the Atomic Energy Act of 1946 (60 Stat. 755). This activity was terminated by Executive Order 9908 of December 5, 1947, which required the reservation to the United States of fissionable material in all disposals of land theretofore or thereafter acquired, except in any tract "not in excess of one acre and which is devoted primarily to a residential use."

From field headquarters in Colorado, Wyoming, Montana, Utah, California, New Mexico, and Oklahoma, division geologists made numerous "spot" investigations precedent to public-land and mineral-leasing law administration, which resulted in sundry reports and maps for official use; in a published map of the areal and structural geology of the Mush Creek area, Weston County, Wyo.; and in the submission for publication of like maps of T. 36 N., R. 2 W., and T. 34 N., R. 4 W., Toole County, Mont., and of the Lothair area, including the Marias River Dome, Liberty County, Mont. One division geologist was on detail the entire year to the Department of Justice in connection with the proceedings in the case of the *Confederated Bands of Ute Indians* v. *the United States*, No. 45585 in the United States Court of Claims.

OIL AND GAS SUPERVISION

The Oil and Gas Leasing Division supervises drilling operations for the discovery and production of petroleum, natural gas, and liquid petroleum gases from leases on public lands of the United States, naval petroleum reserves, acquired lands transferred from the Department of Agriculture to the Department of the Interior under section 402 of the President's Reorganization Plan No. 3 of 1936, and all Indian lands subject to departmental jurisdiction, both tribal and allotted, except those of the Osage Nation in Oklahoma. During the year these duties were accomplished through 20 field offices and suboffices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming. On public lands 13,438 oil and gas properties were under supervision at the end of the fiscal year, aggregating 10,702,702 acres in 22 States and Alaska, an increase of 23 percent in the number of properties and 32 percent in the acreage under supervision at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 771 wells and the completion of 753 wells, of which 591 were productive of oil and gas and 162 were barren. In all, 13,401 wells, including 7,459 capable of oil and gas production, were under supervision on June 30, 1948. The production from petroleum deposits of the public lands during 1948 was substantially greater than during 1947. Production from public lands during the year amounted to 74,387,000 barrels of petroleum, 124,118,075,000 cubic feet of natural gas, and 152,093,000 gallons of gasoline and butane, rendering royalty returns of $20,834,000 to the United States.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 41 new unit plans during the year and the termination of 15 previously approved unit plans, leaving 163 approved plans covering 2,365,881 acres outstanding on June 30, 1948. About 55 percent of the petroleum, 62 percent of the natural gas, and 80 percent of the gasoline and butane obtained from public lands during the year were produced under approved unit agreements.

In addition, one Indian-land unit agreement covering 8,972 acres was terminated during the year and one other, covering 2,713 acres, was in effect during the year. There were also 25 drilling-unit agreements approved during the year, making a total of 58 approved as of June 30, 1948; these agreements involved isolated small tracts, which are consolidated to form a logical drilling unit and, in effect, constitute an agreement similar to a unit agreement, though involving only a small segment of a single field or pool.

On Indian lands the work of oil and gas lease supervision involved 5,913 leaseholds in 12 States, containing at the end of the year a total of 7,983 wells, 4,574 of which were productive of oil or gas and 337 of which had been completed during the year. Total revenue from such operations, as royalties, rentals, and bonuses, amounted to $7,609,000.

On behalf of the Department of the Navy, supervision was continued in 1948 over operations for the production of oil, gas, gasoline, and butane from 21 properties under lease in Naval Petroleum Reserves No. 1 and No. 2 in California. Production during the year from 273 active wells on Reserve No. 2 (none on Reserve No. 1) amounted to 3,135,800 barrels of petroleum, 3,773,000,000 cubic feet of natural gas, and 7,675,000 gallons of natural gasoline and butane, having an aggregate royalty value of $1,099,000.

On Department of the Army lands in the Rio Vista gas field the work included the consideration and approval of a number of the revisions in participating percentages for these lands and the computation of royalties due the United States on the gas production allocated to the lands in the amount of 4,319,374,000 cubic feet, with a royalty value of $293,600.

Production from acquired lands amounted to 681,000 barrels of petroleum, 379,629,000 cubic feet of natural gas, and 1,995,000 gallons of gasoline and butane.

WATER AND POWER CLASSIFICATION

The field work of the Water and Power Division in 1948 was chiefly obtaining basic information concerning the water-power resources and storage possibilities of Federal lands, on which projects were proposed for early development. Work was expanded in Alaska and was continued in the Missouri River Basin to meet the needs of the Bureau of Reclamation and the Corps of Engineers, United States Army, for maps to use in planning future projects.

Topographic surveys were made of three dam sites, 26 square miles of reservoir site, and 200 linear miles of river channel, of which 180 miles are in the Missouri River Basin. In cooperation with the Water Resources Branch, supervision of construction and operation was given to 159 power projects under license with the Federal Power Commission, to 263 such projects under permit or grant from the Department of the Interior, and to 173 in cooperation with the Bureau of Indian Affairs.

Classification of lands resulted in the addition of 51,493 acres to power-site reserves and elimination of 77,105 acres, decreasing the outstanding reserves in 23 States and Alaska to a net total of 6,768,997 acres. Maps published covered 1,640 miles of stream channel of 14 rivers, 43 square miles of reservoir sites, and 37 dam sites. Final action involving hydraulic determination was taken on 500 cases received from departmental sources and the Federal Power Commission, and on 3,728 cases that also involved mineral classification. Investigations and studies were in progress involving the power and storage possibilities of 37 rivers. Reservoir site reserves in nine States remain unchanged at 137,172 acres.

MINING DIVISION

The Mining Division is responsible for the supervision of operations for the discovery and production of coal, potassium, sodium, phosphate, oil shale, sulfur, and silica sand on public domain lands; of gold, silver, and mercury on certain land grants; of quartz and vanadium under departmental authorizations; and of all minerals, except oil and gas, on segregated, restricted, allotted, and tribal Indian lands and acquired lands transferred to the Department of the Interior from the Department of Agriculture under section 402 of the Presidential Reorganization Plan No. 3 of 1946.

In addition to the aforementioned minerals, these operations involved the production of copper, manganese, uranium, asbestos, limestone, gravel, sand, marble, silica, iron, gypsum, vermiculite, pumice, clay, fluorspar, feldspar, lead, zinc, barite, mica, tungsten, and garnet. Sodium production included salt, borax, salt cake, soda ash, and associated lithium and bromine.

As of June 30, 1948, there were under supervision 956 properties—607 on public domain, 265 on Indian, and 84 on acquired lands—under lease, permit, and license. These included 4 secretarial authorizations and involved lands in 12 Eastern States, 16 Western States, and Alaska. The work was directed from seven field offices in the States and one in Alaska.

Production supervised during the fiscal year is estimated at 14,882,500 tons valued at $85,822,000, with accrued royalties of $2,794,000, indicating an approximate increase over the preceding year of 450,000 tons in production, $10,000,000 in value, and $200,000 in royalties. Total income, including royalties, rentals, and bonuses, is estimated at $2,869,000.

The Division is charged with the responsibility of recommending lease terms, enforcing regulations governing the conduct of prospecting and mining operations relating to the safety and welfare of employees, protecting the natural resources, preventing waste, determining royalty liability of lessees and obtaining compliance with lease terms and adherence to approved mine-development plans.

Technical service and assistance are rendered the Office of the Secretary of the Interior, the Bureau of Indian Affairs, and the Bureau of Land Management, in the administration of mineral leases, permits, and licenses and related matters. Consultative service is rendered the Department of Agriculture, the Federal Public Housing Authority, the Bureau of Indian Affairs, and other Federal agencies on the appraisal of mineral lands. Operations and production from public lands owned by the Reconstruction Finance Corporation and the Department of the Army were supervised. Cooperation was given the Bureau of Public Roads in determining the relative merits of applications for access roads and the Reconstruction Finance Corporation in considering loan applications involving public-land lessees.

Production of coal from public lands of approximately 7,980,000 tons represented a decrease of 500,000 tons from the preceding fiscal year, attributable largely to strikes. This decrease was largely offset, however, by the production of 885,834 tons from Indian lands in Oklahoma, an increase of 376,000 tons. Utah continued in first place with a production of 2,767,000 tons, Wyoming second with 2,239,000 tons, and Montana third with 1,335,000 tons. Modification of the leasing act by the act of June 3, 1948, which doubled allowable holdings, gave a needed incentive to the development of a healthy western coal industry.

Oil interests and eastern coal producers, looking to the future production of synthetic liquid fuels from coal, showed interest during the year in the acquisition of western coal lands. The Division cooperated with the National Petroleum Advisory Committee in the selection of sites for the production of 50,000 barrels of oil a day for 30 years, involving 200,000,000 tons of bituminous coal reserves, 300,000,000 tons of lignite reserves, and 50 to 75 million gallons of water a day. Fifteen potential sites were recommended to the Military—five in North Dakota, four in Montana, two in Wyoming, two in Colorado, one in New Mexico, and one in Alaska.

Potassium production established a record of more than 1,000,000 tons K_2O equivalent, and, for the first time, exceeded the value of coal produced from public lands. More than 97 percent of the national output of potash salts is produced by four Government lessees—three in New Mexico and one in California. During the year, all of them added to plant facilities for increased production and recovery and improved products.

Production of phosphate from public and Indian lands of 597,789 tons represented an increase of 40 percent over the preceding year. Field investigations disclosed a potential annual production capacity of 2,000,000 tons of phosphate from lands in Western States. Ground was broken for the construction of an electric furnace for the production of elemental phosphorus by the Westvaco Chemical Corp. at Pocatello, Idaho, and a contract was let by that corporation for the construction of 18 miles of railroad from Fort Hall, Idaho, to service mine operations on Indian land. The railroad will be of benefit also to public lands in that vicinity. One phosphate lease on public domain lands and 26 leases on Indian lands were issued during the year. Many phosphate lease applications involving public lands are pending before the Department.

The brine of Searles Lake, in California, under potassium leases was the principal source of sodium compounds. Refined salts from that source contain potassium, borax, soda ash, salt cake, bromine, burkite, and sodium lithium phosphate. The Ozark-Mahoning Mining Co. prospected intensively for sodium sulphate in the Carlsbad, N. Mex., area, and prospecting for sodium, particularly sulphate, continued in widely scattered areas in California, Nevada, North Dakota, and Oregon. A 1,500-foot shaft put down by the Westvaco Chemical Corp. on Union Pacific Railroad lands 18 miles west of Green River, Wyo., to mine a bed of natural trona (sodium carbonate-sodium bicarbonate) went into production in November 1947. Two adjoining sections of Government land leased by that corporation will be developed through the shaft.

Lead and zinc concentrate production from Quapaw Indian lands in Oklahoma amounted to 42,490 tons as compared to 62,000 tons for 1947 fiscal year. The termination of premium payments resulted in the closure of marginal mines and, although some of them reopened as prices increased, a number have remained closed. A study of the ore reserves, begun in 1944 and completed during the year, provided valuable information for the continuance of mining operations and for further prospecting.

Fluorspar (calcium fluoride), essential to steel production, was the principal product from acquired lands in Illinois that are also valuable for lead and zinc. Other minerals from acquired lands include coal, silica, feldspar, mica, and asbestos. Prospect operations for barite continued in Arkansas and Missouri. Barite is in great demand for use as heavy mud in deep-well drilling for oil and is potentially one of the most important products from acquired lands.

The search for new sources of minerals and the assimilation of data from mining and exploratory operations have been diligently pursued by the Division within the limits of its facilities and personnel. Past experience demonstrates conclusively the economic value of chemical and mineralogical examinations of cuttings and cores from wells drilled for oil, gas, and water. For instance, the New Mexico potash industry was founded on the discovery of sylvite, a potash mineral, through a mineralogical examination of cuttings from a well drilled for oil, and the mineral trona, a sodium carbonate-sodium bicarbonate mineral, was discovered in Wyoming through an examination of core from a well drilled for oil. In the past, cuttings and cores from only a very small percentage of the wells drilled for oil have been examined to determine what minerals are present in the formation penetrated by the drill, and practically none are now being so examined. A systematic examination of cuttings and cores is considered exceedingly important as a means of increasing known potential mineral resources at minimum cost. The discovery of a valuable mineral, even at great depth, furnishes a clew to guide future prospecting.

Work on Publications

TEXTS

During the year 93 new manuscripts were received by the Section of Texts, 75 manuscripts were sent to the printer, and 61 publications were delivered by the printer. Work on these included 5,178 pages of manuscript edited and prepared for printing; 1,428 galley proofs and 5,369 page proofs revised and returned; indexes prepared for 15 publications, covering 2,330 pages and consisting of 2,678 entries. Copy edited in preparation for mimeographing included 55 press releases, consisting of 100 pages and 51 pages of miscellaneous material.

Reports delivered were as follows: Professional Papers 208, 210–E and 211; Bulletins 935 (volume title page and contents), 944–B, 946 (volume title page and contents), 948–A, 953–A and C, 954–A, 955–A, 957–A to D, and 959–A; Water-Supply Papers 866–C, 966, 968–A to C, 992, 997 to 999, 1016, 1018 to 1022, 1031, 1032, 1034, 1036, 1043, and 1046 to 1049; and Circulars 15, 17, 18, 22, and 23. These cover a wide range of subject matter—general geology of particular areas; mining districts and local mineral deposits in the United States, the Dominican Republic, and Argentina; studies of fossils and the rocks in which they are found; a collection of papers on geochemical research; geophysical abstracts, a quarterly serial; measurements of streamflow and of water level and artesian pressure in wells; general studies of underground water and of the occurrence of floods, with consideration of the influence of geology and physiography.

In order to keep the public informed, seven lists of new publications were issued. Also printed during the year were a general list of publications issued up to May 1948; five State index circulars indicating maps and reports for Louisiana, Massachusetts—Rhode Island—Connecticut—Pennsylvania—New Jersey, and Virginia, also Puerto Rico; a rock-color chart; and a new list of map symbols for geologic maps.

ILLUSTRATIONS

The Section prepares the illustrations to accompany the regular reports (professional papers, bulletins, and water-supply papers) for the Geological Survey.

At the beginning of the year there were a total of 38 reports on hand, 14 in the various stages of progress. During the year 27 new reports were received and 21 transmitted, leaving a total of 44 reports on hand, of which 18 were in various stages toward completion. Those transmitted included 2 professional papers, 11 bulletins, and 8 water-supply papers, and consisted of 1,023 completed drawings and photographs which comprised 264 maps, 181 geologic sections, 265 retouched photographs, 116 diagrams, and 197 miscellaneous drafting jobs.

The increasing complexity and size of the papers now being processed will have a continued bearing on the number of publications and the amount of illustrations completed in the coming fiscal year.

MAP REPRODUCTION

During the year, 25 newly engraved topographic maps were printed. A total of 264 new maps were printed and delivered, including 188 multicolor topographic maps, 10 index maps, 19 preliminary geologic maps, and 22 special maps. Reprint editions of 306 engraved topographic maps, 26 multicolor maps, and 32 photolithographed State geologic, planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 628 different editions, amounting to 1,955,180 copies, were delivered.

A large amount of the year's work in the map reproduction plant included the engraving and printing of various types of maps for 45 other Government units and States. Charges for this work amounted to $237,422, for which the Division was reimbursed.

Transfer impressions and velox and plate prints numbering 158 were made during the year.

The printing of topographic maps and contract and miscellaneous work of all kinds, resulted in a grand total of 2,497,078.

The photographic laboratory made 4,747 negatives, 48,969 prints, 3,549 photolith press plates, 3 intaglio etchings, mounted 279 prints, and developed 31 film packs, 363 rolls of film, and 47 prints.

FUNDS

During the fiscal year 1948 there was available for obligation under the direction of the Geological Survey a total of $22,410,915. Of this amount $10,241,443 was appropriated directly to the Geological Survey, and $12,169,472 was made available by other Federal agencies and by States and their political subdivisions. In addition, $10,995 was allotted from the appropriation for contingent expenses of the Department of the Interior for miscellaneous supplies.

Funds available to the Geological Survey in fiscal year 1948 from all sources

Administrative salaries and expenses: Interior Department Appropriation Act		$232,340
Topographic surveys:		
Interior Department Appropriation Act	$3,000,000	
States, counties, and municipalities	712,778	
Bureau of Reclamation	1,075,978	
Department of the Air Force	647,955	
Department of the Army	1,931,032	
Department of Commerce	7,981	
Department of the Navy	35,322	
Public Roads Administration	49,362	
Miscellaneous repay	347,850	
		7,708,258
Geologic surveys:		
Interior Department Appropriation Act	2,300,000	
States, counties, and municipalities	102,268	
Bureau of Mines	6,503	
Bureau of Reclamation	256,832	
Department of the Army	567,600	
Department of the Navy	18,531	
Department of State	149,636	
Atomic Energy Commission	2,139.779	
Miscellaneous repay	26,638	
		5,567,787
Mineral resources of Alaska:		
Interior Department Appropriation Act	250,000	
Department of the Navy	173,137	
Miscellaneous repay	7,026	
		430,163
Gaging streams:		
Interior Department Appropriation Act	2,625,000	
Supplemental appropriation	485,000	
States, counties, and municipalities	2,026,909	
Bureau of Reclamation	689,881	
Office of Indian Affairs	20,126	
Office of Land Utilization	35,222	
Department of the Army	586,147	
Department of the Navy	7,312	
Department of State	106,276	
Atomic Energy Commission	11,733	
Public Health Service	5,825	
Tennessee Valley Authority	78,184	
Permittees and licensees of Federal Power Commission	40,485	
Miscellaneous repay	19,987	
		6,738,087

Funds available to the Geological Survey in fiscal year 1948 from all sources—Con.

Classification of lands:		
Interior Department Appropriation Act	$245,000	
States, counties, and municipalities	930	
Bureau of Reclamation	100,724	
Department of Justice	7,294	
Miscellaneous repay	7,521	
		$361,469
Mineral leasing:		
Interior Department Appropriation Act	650,000	
Department of the Navy	23,000	
Miscellaneous repay	8,286	
		681,286
Printing and binding: Interior Department Appropriation Act		120,000
Preparation of illustrations: Interior Department Appropriation Act		32,000
Engraving and printing geologic and topographic maps:		
Interior Department Appropriation Act	$237,000	
Miscellaneous repay	237,422	
		474,422
Payments from proceeds of sales of motor-propelled vehicles, etc., special account		65,103
Total funds available		22,410,915

Oil and Gas Division

MAX W. BALL, *Director*

THE Oil and Gas Division, which was created in response to the President's letter to the Secretary of the Interior, dated May 3, 1946, is charged with the duties of keeping the President informed on significant petroleum developments, advising him as to any steps necessary to protect the Nation's petroleum future, coordinating and unifying the administrative activities and policies of other Government agencies with respect to oil and gas, recommending appropriate centralization of oil and gas activities, serving as the channel of communication with State oil and gas bodies and with the petroleum industry, and of administering the Connally "Hot Oil" Act.

These broad duties lead to the over-all consideration, on an advisory basis only, of oil and gas matters in which some 40 agencies are engaged. A large proportion of the Division's work originates in requests from other agencies for advice and assistance.

During this fiscal year, the military procurement agencies and the Bureau of Federal Supply (Treasury) called upon the Division for help when they experienced difficulty in obtaining minimum required quantities of petroleum products. A National Petroleum Council Committee aided in securing products and the Division assigned each individual refiner his equitable quota of Government supplies and asked him to furnish it. The military and other Government requirements were eventually met in full.

The Department of Commerce asked for help in preparing data covering the entire steel needs of the oil and gas industries for 18 months beginning April 1, 1948, as a basis for formulating voluntary agreements, under Public Law 395, with the steel industry. Working through a National Petroleum Council Committee and the American Gas Association this tremendous task was completed.

The Division initiated action for placing major petroleum products under export control on July 1, 1947, because of the impending scarcity of certain petroleum products. Advice and counsel were given to the Department of Commerce in its administration of export controls and to other agencies to enable them to better cooperate with the Department of Commerce on export matters related to petroleum and steel.

Congressional inquiries and investigations of oil and gas matters required much time and preparation. Staff of the Division attended 47 congressional hearings during the year Personally appearing as witnesses were the Secretary of the Interior at 5 hearings; Under Secretary, 3; Assistant Secretaries, 5; Director of the Division, 21; Assistant Directors, 7; Special Assistant to the Director, 2.

In the fall of 1947, the petroleum stock position indicated imminent shortages of petroleum products throughout the area east of the Rocky Mountains, particularly on the Atlantic Seaboard and in the Middle West. Action was deemed necessary to reduce the consumption of fuel oil, gas, and gasoline to relieve the critical situation. The Secretary of the Interior called upon the National Petroleum Council to create a committee and to recommend measures to be taken by Government, industry, and the public to conserve products or to increase supplies. The Oil and Gas Division working with the Council Committee developed plans for a voluntary program for conservation of petroleum products. The Secretary of the Interior issued an appeal to the public for a 15 percent reduction in consumption by all users of gasoline, fuel oil, and gas. The Division was active in cooperating with and assisting the fuel coordinators or committees, appointed by the Governors of 32 States and by the District of Columbia, in the solution of problems in the areas of shortages. The oil industry sponsored an intensive conservation campaign. In addition, the President issued an Executive order directed to all departments and independent agencies to observe and enforce nine specific rules to save gasoline, fuel oil, and gas. Following passage of Public Law 395, Eightieth Congress, relating to industry agreements and plans for voluntary action for the allocation of scarce commodities which basically affect the cost of living or industrial production, the President, by executive order (No. 9919 dated January 3, 1948), delegated to the Secretary of the Interior full authority with respect to fuels, including petroleum and petroleum products, and natural and manufactured gas. A temporary plan to alleviate consumer hardship and to promote equitable distribution of petroleum products was in effect from January 28 to June 15, 1948, during the periods of shortages of heating oils and tractor fuel. This plan required the creation and functioning of three industry advisory committees as well as numerous subcommittees under the National Petroleum Council. The Oil and Gas Division maintained liaison, coordinated and counseled with these committees, fuel coordinators, industry, and other Federal and State agencies. The Division is working on the formulation of a permanent plan under Public Law 395.

The Interdepartmental Petroleum Committee was created July 8, 1946, by the Secretary of the Interior to assist in coordinating and unifying the oil and gas activities of the Federal Government. It considers petroleum matters of national interest, particularly those affecting more than one department or agency. The committee has been exceedingly active, and participation now includes 17 departments and agencies, with meetings being held bimonthly or even more frequently if problems arise requiring special attention. A special subcommittee was created and assisted the Department of State in evaluating the Paris Report, a compilation of the petroleum and petroleum equipment requirements of the 16 foreign countries included in the European Recovery Program. The Division likewise assisted in preparation of material for presentation to Congress in support of appropriation of Marshall Plan funds. Another subcommittee is working on fundamentals of the present petroleum situation, forecasting the short-term and long-term prospects, and posing problems that should be solved in the formulation of a national oil policy for consideration by the Cabinet. Through this close contact and cooperation between the interested departments and agencies the Committee functions with outstanding success. All members are currently informed on oil and gas matters with the result that duplication of Federal petroleum activities is avoided.

The National Petroleum Council was created on June 18, 1946, by the Secretary of the Interior upon the express suggestion of the President, to serve as the channel of communication and liaison between the Government and the petroleum industry. The Council comprises 90 members, representing every segment of the industry, from individual producers and filling station operators to heads of the largest integrated companies. Its services and recommendations are made available to all Government agencies. The Government is acutely aware of the necessity of cooperative relations between Government and industry and is extremely fortunate to secure through this body the accumulated and concentrated knowledge and wisdom of the petroleum industry, the most complex and the second largest industry in the United States. Outstanding accomplishments during its second year of existence were (1) the development and effectuation of a temporary voluntary petroleum allocation agreements program for the relief of consumer hardship caused by fuel-oil shortages during the unusually severe winter of 1947–48, and the later tractor fuel shortage in the Middle West; (2) securing industry cooperation in supplying military and Government petroleum requirements, (3) preparation of the first comprehensive determination of petroleum industry steel requirements; and (4) analysis of the report containing petroleum requirements of the 16 nations under the Marshall Plan. In addition, the Council completed studies, prepared economic and factual reports, and made recommendations on numerous matters affecting the petroleum economy of the world. Some of these included reports on petroleum production and crude oil availability, petroleum products supplies and availability, United States refining capacity, liquefied petroleum gas production and availability, Government royalty oil regulations, tanker and other transportation facilities, and military aircraft fuels productive capacity. During fiscal 1948 a total of 343 experts from the industry rendered invaluable services on the Council and its 49 committees and subcommittees.

Military Petroleum Advisory Committee.—In recognition of the basic importance of petroleum in war and the value of expert industry advice in highly secret emergency planning, the Secretary of the Interior, on March 29, 1947, established a committee of 17 outstanding experts in various phases of petroleum operations to serve as confidential advisers to the National Military Establishment, the National Security Resources Board, and the Oil and Gas Division on petroleum preparedness and mobilization, both civilian and military. The committee held its first meeting in Washington in July 1947. During the past year, 154 experts of petroleum and allied industries served on committees and subcommittees, gathering essential data and developing programs at the request of the Armed Services and the Oil and Gas Division on matters relating to national security and defense. The committee will present a report soon on nine major defense problems presented to it.

Liaison With State Bodies

Through members and examiners of the Federal Petroleum Board the Division has direct relations with State conservation and regulatory bodies. The Division has nonvoting membership on the Interstate Oil Compact Commission, which exists for the sole purpose of conserving and protecting irreplaceable natural resources, and was represented at all meetings. The Division is represented on the Compact's Secondary Recovery Advisory Committee, which deals with development and inauguration of plans for obtaining maximum ultimate production of crude oil and recovering additional oil from old or abandoned fields.

Federal Petroleum Board

The Federal Petroleum Board, successor of Federal Tender Board No. 1, was created under authority of the Connally "Hot Oil" Act by order of the Secretary of the Interior on October 27, 1942. Under the supervision and direction of the Oil and Gas Division, the Board administers the Connally Act. With headquarters at Kilgore, Tex., and suboffices at Houston and Midland, Tex., and Lafayette, La., the Board enforces regulations under the act in the States of Texas, Louisiana, New Mexico, Oklahoma, Arkansas, and Kansas, directing its primary efforts to operations in the first three States. Its operations also extend to other oil-producing States having laws which limit and prorate production of crude oil, whenever warranted and to the extent feasible.

In administering the act and enforcing the regulations thereunder the Board directs a small examining force which makes physical inspections of production, transportation, storing, and processing of petroleum, and investigates the reports filed monthly with the Board pursuant to the regulations.

From within a prescribed area which includes only 102 counties in Texas, 2 in New Mexico, and the entire State of Louisiana, the Board receives and processes each month some 4,000 reports from some 1,660 different sources, relating variously to production, transportation, and processing of petroleum. Of the fields and wells embraced within this prescribed area, reports are required covering operations in 419 separate fields, with more than 50,000 oil wells, the total monthly production from which averaged 63,378,175 barrels, or 38.5 percent of all oil produced in the United States.

Consistent with the established policy of the Board, operators in about 400 fields in the designated area were relieved during the fiscal year from the duty of filing producers' monthly reports and details of receipts from leases in the transporter's monthly reports, until further notice, in consequence of the Board's finding that such reports presently serve no useful purpose. For the same reason, the regulation requiring the filing of reports by natural gasoline plants was suspended.

ACTIVITIES

Enforcement activities were directed primarily toward the prevention of violations of the act, as far as possible, in the areas where opportunities and inducements to disregard the act and regulations were present, and, through judicial application of the penal provisions of the act, to secure the redressing of the more important violations which occurred notwithstanding the preventive measures employed.

In the process of carrying on these enforcement activities during the fiscal year, there was a total of 2,035 lease visits; 1,332 lease inspections; and in addition 831 leases were fully gaged and checked, while 112 pipe lines and pump stations were inspected and checked. More than 2,400 interviews were conducted, hundreds of witnesses were interrogated, and many investigative hearings were held. The examiners and Board members traveled a total of more than 135,000 miles in carrying on the field inspections and conducting the interviews, interrogations, and hearings mentioned above.

CASES

At the beginning of the fiscal year 12 Connally Act cases and investigations were pending, of which 2 were old cases pending in court for several years, 2 were pending consideration in the Department of Justice, 2 pending review in the office of the Oil and Gas Division and that of the Solicitor of the Department of the Interior in Washington, 1 was pending administrative action by the Board, and 5 were in an investigative stage. During the fiscal year 10 new formal case investigations were opened, 1 old and 8 current cases were closed by successful court action during the year, 1 was closed administratively by concurrence of the Department of Justice and the Department of the Interior, following failure of a Federal grand jury to indict, leaving 12 cases pending as of June 30, 1948, of which 1 is an old case still pending in court in Louisiana, 2 are pending administrative disposition by the Board, and 9 are still in an investigative stage.

Of the nine cases closed by successful court action, three originating in the Kilgore office resulted in the imposition of fines of $4,000, three originating in the Midland office resulted in the imposition of fines aggregating $79,800, one originating in the Houston office resulted in the imposition of a fine of $2,500, and two originating in the Lafayette, La., office resulted in imposition of fines of $3,500. The fines imposed during the period totaled $89,800, which was exceeded in only two previous fiscal years, 1937 and 1942. By comparison, during the fiscal year 1946 five cases were closed by successful court action resulting in the imposition of $42,000 in fines, and during the fiscal year 1947 two cases were closed by successful court action resulting in the imposition of $3,500 in fines.

COOPERATION WITH OTHER PUBLIC AUTHORITIES

The Board actively cooperates with the local oil and gas conservation and other State and Federal authorities in the several States where its operations are carried on, and during the fiscal year substantial sums in delinquent taxes, penalties, and interest were collected by State and other Federal authorities respectively, largely through the Board's cooperation.

Office of Land Utilization

LEE MUCK, *Assistant to the Secretary*

THE Office of Land Utilization was established under authority of Order No. 1466, dated April 15, 1940, for the purpose of coordinating the land and resource management activities of the Department. Coordination of the land programs of the Department involves the integration of reports and plans; the correlation of general management policies; and the resolution of conflicts between the bureaus and offices of the Department, or between the Department and other land-management agencies operating in the field of natural renewable resource conservation.

Experience in Interior during the past several years has clearly demonstrated the value of effective cooperation in the management of natural resources. It seems obvious, moreover, that the coordination of the conservation activities of a department organized on a bureau basis can be secured by procedures less drastic than complete centralization, and that a common plan of action is possible of attainment without seriously disrupting well-established bureau organizations.

Specifically, the functions of the Office of Land Utilization consist of coordination and planning, the rendering of technical advisory service, and the dissemination of information in the field of natural renewable resource conservation; the direction of the Soil and Moisture Conservation Program of the Department; the development of unified forest management policies and practices; the coordination of water utilization programs; and the review of the land classification actions of the bureaus of the Department covering land disposal, land withdrawals, and related activities. A detailed discussion of the activities of the Office during the year 1948 follows:

Soil and Moisture Conservation

The year 1948 saw more real progress in soil and moisture conservation on lands under the jurisdiction of the Department of the Interior than was made during the previous 7 years of operation. This progress is the result of a more realistic approach by the land-management agencies in the correction of faulty land-management practices; a larger appropriation; and a marked increase in the number of cooperators and the amount of contributions providing for the rehabilitation and care of public and Indian lands.

The Soil and Moisture Conservation Program has introduced new concepts of bureau responsibility in the management of land, as well as new practices in land use. The administrative agencies of the Department more fully recognize that the complete coordination of all land and resource management activities is essential to real and lasting accomplishments in securing proper land use and that the proper care of land and resources upstream is of vital importance to the continued use of lands, resources, and facilities downstream. Accordingly, increased attention has been given to the development of interdepartmental and intradepartmental cooperation in soil and moisture conservation operations on a watershed basis. This development has tended to unify action and concentrate operations where the greatest need exists and the greatest benefits can be secured.

Concurrently there has been a noticeable increase in requests for advice and assistance from the users of public and Indian lands. The actual cash and other contributions made for rehabilitating these depleted lands have materially exceeded the amounts authorized for expenditure from the Federal Treasury.

Under these favorable conditions the number of improvements constructed in connection with the program increased rapidly during the past year. To these can be added numerous others directly constructed by interested land users and owners following the same procedures and practices as in the regular program. The demonstrated worth of well conceived and properly constructed physical improvements on the land, together with the increased productivity from lands where improved use practices have become effective, is proving both an incentive and a challenge to private landowners and users to share in the benefits that are obtainable.

During the year additional projects were established looking to the construction of dikes and levees to divert floodwaters from small gullies and washes and to spread these waters over adjacent watershed areas. A great deal of work has been done in stabilizing streambanks which in the past have proved to be a major source of silt deposits that interfere with irrigation and other impoundments downstream.

The revegetation operations under the program have been seriously retarded in some States due to the unusual drought conditions prevailing. In other localities where climatic conditions were more favorable, the results obtained have been very encouraging.

Despite these and many lesser physical accomplishments, the job of restoring to full productivity the many millions of acres of lands under the jurisdiction of the Department of the Interior is only just begun. With the continued cooperation and support of all concerned, the outlook for the future is extremely encouraging.

Forest Management

The forest resources under the jurisdiction of the Department of the Interior are protected and managed in accordance with sound conservation policies and the legal requirements with respect to the application of the principles of sustained-yield forest management. Under development plans devised by the operating bureaus and coordinated by the Office of Land Utilization, the commercial forests managed by the Department produced during the year one and a quarter billion board feet of timber valued at more than $6,790,000, which is a 25 percent increase in volume and a 35 percent increase in value over the 1947 cut.

Part of this increase in production is attributed to the sale of green timber from the unappropriated and unreserved public domain lands in the continental United States, which was authorized by Public Law 291, approved July 31, 1947. For the first time in the history of the Department, statutory authorities are now complete for the management under forestry principles of all of its commercial forest properties.

That phase of the Department's forest management program relating to the cooperative management of intermingled public and private forest properties was advanced materially by the approval on November 29, 1947, by the Secretary, of the remaining 11 master units for the O. & C. lands, and by the decision following public hearings on January 21 and 22, 1948, on the first proposed sustained-yield unit—the Mohawk River Sustained Yield Forest Unit—to consummate cooperative forest management agreements.

Basic to intensive forest management is the adequate protection of the forest resources from fires, insects, and diseases. Fire control was reasonably successful during the year with only one-half of 1 percent of the total area requiring protection being burned over. White Pine Blister Rust Control made remarkable progress with the record showing as of December 3, 1947, that 60 percent of the white pine forests had been worked initially and that 32 percent were on a maintenance basis. The Forest Pest Control Program, authorized by Public Law 110, approved June 25, 1947, was established on a fully coordinated basis within the Department and integrated within the national program instituted by the Department of Agriculture. The first control work by this Department under this authority was against an epidemic infestation of the mountain pine beetle in western Wyoming.

Water Resource Coordination

During the year, agencies of the Department, acting through the Water Resources Subcommittee, reviewed 29 reports of the Corps of

Engineers, Department of the Army, concerned primarily with flood control and navigation, and 10 project reports of the Bureau of Reclamation concerned principally with irrigation. Proposed projects by both agencies also have incidental power, flood control, and water conservation benefits. The agencies also reviewed 52 applications for power permits and licenses referred to the Department by the Federal Power Commission, and formulated recommendations designed not only to protect the varied interests of the agencies of the Department, but also to assure, so far as compatible with the primary purpose of the proposed projects, that in project construction and operation, appropriate consideration be given to all uses of water. In addition, the three major departmental reports, namely, the Colorado River, the Columbia River, and the Central Valley of California, were reviewed.

The Water Resources Subcommittee maintained liaison between the Missouri Basin Field Committee and the Department in order to assure proper coordination of the Missouri Basin program as a whole. In addition, contact was maintained with the chairman of the Missouri Basin Field Committee in his capacity as representative of the Department on the Missouri Basin Inter-Agency Committee, thus assuring, so far as practicable, coordination of the Department's program with those of other agencies represented on the interagency committee.

The executive officer of the Water Resources Subcommittee acted as alternate to the Department's representative on the Federal Inter-Agency River Basin Committee, and after January 1, 1948, as secretary of that committee. Agencies were kept advised throughout the year of action by the Federal Inter-Agency River Basin Committee, its two field committees (the Missouri Basin Field Committee and the Columbia Basin Inter-Agency Committee), and its technical subcommittees (Hydrologic Data, Sedimentation, Benefits and Costs), and other interagency working groups, in order that agencies of the Department might actively participate in these technical coordination activities in which they are especially interested.

Land Classification and Land Policy

The Office of Land Utilization develops and reviews policies for determining the types of public land which should be retained in public ownership and those which may be transferred or leased to individuals under the various public land laws. It maintains appropriate relationships with Federal, State, and local land-administering agencies to insure correlation between the policies of such agencies and those of the Department of the Interior.

About 900 documents from various bureaus, involving disposal, reservation, withdrawal, and restoration of public lands, were reviewed, of which 80 were appeals from decisions of the Bureau of Land Management rejecting applications for homesteads and other entries on public land.

The Director of Land Classification served as chairman of a committee which held hearings at Hot Springs National Park, Ark., and made recommendations for allocation of additional hot spring water to concessioners, and as a member of a committee which, after hearing at San Francisco, recommended revised labor regulations for concessioners in national parks.

Representatives of the Office of Land Utilization have served on the Organizing Committee of the Inter-American Conference on Renewable Resources held in Denver, Colo., in September 1948, and on the Inter-Departmental Technical Committee of the United Nations Scientific Conference on Conservation and Utilization of Resources, to be held in 1949. The office participated actively in the preparation of reports to the Commission on Organization of the Executive Branch of the Federal Government and to the Council of Economic Advisors.

Bureau of Land Management

MARION CLAWSON, *Director*

THE end of the 1948 fiscal year marked the beginning of a new era in the administration of the public lands of the United States under the Bureau of Land Management. New programs were devised for the management and protection—and selective, rather than summary, disposal—of the approximately 778 million acres of public domain and their natural resources in continental United States and Alaska. In addition to these steps to insure the best use of the public lands for the benefit of all the people, new procedures were installed to provide neighborly handling of land-administration problems in local offices, rather than through long-range negotiations conducted in Washington.

These two innovations in administration are striking evidences of the progressive advancement in the realm of public-land management. They represent the ever-increasing cooperation of citizens and Government for mutual advantage. They paved the way for an even greater beneficial use of land and resources based upon advancements in the field of science, research, and technology. The intelligent coordination of all these factors should be and is the prime objective of national land-administration policies. That this objective is well within the realm of achievement is shown by the continuity of effort toward better public-land administration under national conservation policies during the past decade and a half.

How to get the most benefit from the use of the public lands of the United States has been an ever present Government concern since the early days of the Republic. The many facets of that problem brought kaleidoscopic changes which became historic landmarks in the evolution of our national land policies. First, was the era of cash disposal, when a large portion of the then seemingly inexhaustible supply of public lands was sold to meet the expenses of the Revolutionary and Mexican Wars. Secondly, was the epoch of land grants as bounty for military service and for public improvements, during which other large areas were made available for the construction of railroads, highways, and canals, and for the benefit of schools and educational institutions in the various States. Next, came the era of homesteading and land settlement, which had its inception at the close of the Civil War and resulted in the expansion of civilization in the Republic westward to the Pacific. It has been estimated that title to more than 1 billion acres of public land passed from the United States during these several different cycles in public-land policies.

It is interesting to note that altogether Congress has passed more than 5,000 laws reflecting its varying policies concerning the public lands and it is of almost equal historic significance that the Department of the Interior, principally through the Bureau of Land Management and its predecessors, has been charged by the Congress with the major responsibility for handling these laws since the establishment of that Department nearly a century ago in 1849. Thus, the record for continuity in administrative experience maintained by the General Land Office, the Grazing Service, and the Bureau of Land Management is surpassed by few other agencies in the Federal establishment.

The Conservation Era

The installation by this Department and its land bureaus of an all-inclusive resource conservation program to replace outmoded national land disposal policies was begun shortly after the enactment of the Taylor Grazing Act of June 28, 1934. Vesting broad administrative authority in the Secretary of the Interior, this statute, in effect, served as the Magna Charta of operations aimed at procuring the maximum beneficial use of the people's land and natural resources. The administrative integration of the many other public land laws into the conservation orbit of the Taylor Act permitted a coordinated land use which proved invaluable to the Nation during both war and peace periods in the decade which followed.

For example, more than 14 million acres of public land in grazing districts established under the Taylor Act were made available for military training purposes during World War II, while the output of meat, leather, and wool were stepped up to meet military demands. At the same time, other public land areas were able to provide needed supplies of oil and gas and other minerals as well as timber and other forest products as a result of the coordinated conservation program.

One of the outstanding benefits derived from the new conservation program was the revenue received from the use of the public land which, for the period from 1934 to 1948 totaled $171,721,013. During the same period, only $44,473,130 was expended in the operations of the Grazing Service, General Land Office, and Bureau of Land Management which collected these receipts—a ratio of $3.86 in income for each dollar of outgo. Under laws that had been amalgamated into the main conservation structure, each State received 37½ percent of the proceeds from mineral production from the public lands arising within its borders, and 52½ percent was deposited in the Federal reclamation fund. Likewise, distribution was made of a proportion of the proceeds from the grazing use of lands within Federal grazing districts, to the States and counties in which those lands are located.

In addition, more than $11,000,000 has been paid since 1934 to 18 western Oregon counties as their share of proceeds from the sale of timber on 2½ million acres of revested Oregon and California railroad grant lands and reconveyed Coos Bay Wagon Road lands within their borders.

Decentralized Administration

Conservation means much more than the observance of prudent, protective rules in the use of the public land. It means greater economy and efficiency in the administrative processes of the Government. It means furnishing faster service to the public in order that the time, energy, and financial capital of private interests may speedily be concentrated upon the development of the Nation's natural resources. A stockman is entitled to expect prompt action upon his application for grazing privileges. Oil and gas and other mineral development should be made possible with a minimum of delay. Other applications for public land use demand speedier action under management and protective policies than was essential during the mere disposal eras.

Long-range studies by this Department showed that the best type of service to the public in Federal domain administration could only be secured through a decentralization of its operations.

The Bureau's program for decentralized operations, carefully integrated with the Department's pattern for regionalized handling of its vast responsibilities to the public, consists, in general, of an administrative structure of greatly strengthened local offices. Under the guidance of strategically placed regional headquarters, these offices provide service to the public in over-the-counter handling of public land problems which hitherto were referred to Washington for consideration.

The location of these regional headquarters and other offices of the Bureau is as follows:

Region I, Portland, Oreg.: Idaho, Oregon, Washington.
Region II, San Francisco, Calif.: California, Nevada.
Region III, Billings, Mont.: Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Montana.
Region IV, Salt Lake City, Utah: Colorado, Utah.
Region V, Albuquerque, N. Mex.: Arizona, New Mexico, Texas, Oklahoma.
Region VI, Washington 25, D. C.: Minnesota, all States east of the Mississippi River, Iowa, Missouri, Arkansas, Louisiana, Wisconsin.
Region VII, Anchorage, Alaska: Alaska.

District Land Offices are maintained by the Bureau at:

Alaska: Anchorage, Fairbanks, Nome.
Arizona: Phoenix.
California: Los Angeles, Sacramento.
Colorado: Denver, Pueblo.
Montana: Billings, Great Falls.
Nevada: Carson City.
New Mexico: Las Cruces, Santa Fe.
Washington: Spokane.
Wyoming: Buffalo, Cheyenne, Evanston.

Public Survey Offices are maintained by the Bureau in:

Alaska: Juneau.
Arizona: Phoenix.
California: Glendale.
Colorado: Denver.
Montana: Helena.
Nevada: Reno.
New Mexico: Santa Fe.
Washington: Olympia.
Wyoming: Cheyenne.

During the year a major step toward better public service was undertaken through the consolidation of some of the Bureau's District Land Offices and Public Survey Offices with the result that combination Land and Survey Offices were established in Portland, Oreg.; Boise, Idaho, and Salt Lake City, Utah. Plans for further extension of this type of on-the-spot service were nearing completion at the end of the fiscal year.

Conservation Accomplishments in 1948

Steadfast adherence to the conservation objectives of the Taylor Grazing Act set the pattern for operations in the Bureau of Land Management during the 1948 fiscal year. With the cooperation of Congress, administrative operations of the Bureau kept pace with the demand for more scientific methods for the development of oil and gas and other mineral resources on the public lands. In furtherance of these efforts revision of Bureau regulations to expedite geophysical mineral explorations and facilitate development of phosphate deposits on the public domain was begun during the year. In conjunction with the Civil Aeronautics Authority, the use of public domain areas for public air ports was increased. Technical assistance was furnished in the surveying, classification, and use determination of public-land areas in many of the integrated basin development programs of the Department.

Cash receipts from the operations of the Bureau of Land Management during the 1948 fiscal year were the highest ever received, the total of $33,286,434 being the highest figure shown in 67 years of Bureau statistical records. This total return from the use or disposal of the public lands was roughly $12,000,000 more than last year. The 1948 expenditure of $4,540,678 represented a ratio of $7.33 for every $1 spent on the operation of the Bureau.

Conservation Future

These new policies and new administrative procedures combine to present new vistas of opportunity for maximum beneficial use of the public domain in the future. Some of this anticipated use depends upon cooperation by Congress in the enactment of remedial legislation. The development of the vast unused tracts of public land in Alaska, for example, awaits congressional sanction of legislation designed to foster the economic and industrial advancement of the Territory. There is pressing need for examination and revision of the present unwieldy legal structure erected by the enactment of more than 5,000 public land laws.

Meantime, however, much of the planning for the future can be undertaken now. For example, laws already enacted provide authority for new regulations of the Bureau of Land Management which will permit broad developments in the field of mineral production. Greater incentive to private interests and wide opportunities for geophysical determinations of the location of petroleum deposits are integral parts of the future land administration pattern. Similarly, the advancement of scientific knowledge in the production of concentrated phosphate fertilizer and chemicals by electric furnace methods points to the greater use of the public domain than ever before as a source for agricultural fertilizer manufactured from low-grade ores hitherto regarded as unsuitable for such purposes.

Airplane reseeding of large areas of the public range is another advancement in land administration which holds great possibilities for the future.

Consolidation or blocking of the public land areas is another problem reflected in the future land pattern. It is often overlooked that there are approximately 200,000 acres of Federal public lands located in States east of the Mississippi River. The disposal of these "isolated tracts" either to local or State governments or to private individuals through public sale should be undertaken as part of the land administration program of the future.

The Public Range

World events during the past 14 years have brought to the American people a profound realization of the importance of range conservation and proper management of our public land resources including vegetation, water, and wildlife, to our national welfare. Conservation of the Federal grazing lands from which is derived a large part of the meat, wool, and leather essential to our continued well being, has been accepted as an important and integral part of our national program. That this acceptance is the result of democratic processes of Government embodying a greater degree of cooperation between individuals and official administrative agencies than ever before attempted, is perhaps the greatest contribution of the Taylor Grazing Act. The significance of this achievement warrants a brief backward glance into the opening of the conservation period.

Home Rule on the Range

Fourteen years ago, on a hot July day, about 800 people crowded into a hotel auditorium in Salt Lake City, Utah, to hear for the first time the essential facts concerning the Taylor Grazing Act of June 28, 1934. On the platform was a group of Interior Department officials who had come to explain the objectives of the new public land law and to obtain from the people suggestions for its operation. The auditorium was filled with people who truly represented a cross section of the West. These people were eager to learn and deeply concerned as to how the grazing law was to affect farmers, stockmen, and the range itself.

At the time, the entire West was in the midst of a great drought, one of the worst on record. Many water holes had dried up, storage in reservoirs was low, fields were parched, crops were failing, and many livestock were dying of starvation. Repeated attempts had been made by stockmen in the West to obtain legislation for control of grazing on the public domain; they had a big stake in whatever program was adopted.

The discussions were straightforward—sometimes heated, but uniformly centered around practical problems in the range country. For example: Cattlemen from Colorado wanted to know how they would be protected from existing migratory range practices; Utah people asked if they could obtain protection from overcrowded winter sheep ranges; the homesteader asked if this act would establish him in the livestock business; sportsmen and wildlife interests inquired about the welfare of game; hundreds of questions focused many problems for discussion and consideration.

Out of the meeting was developed a plan for cooperation between the stockmen and the administration which since has characterized the pattern of range conservation throughout the grazing districts in the 10 Western States. In 1939, Congress made the advisory board system a permanent feature of grazing administration. The appointment by the Secretary of the Interior of advisory boards of stockmen in all grazing districts took the problem right out on the ground for solution. This democratic approach to cooperation and understanding has proved successful both from the standpoint of the administration and that of the industry.

The Taylor Grazing Act has in a large measure served the purpose for which it was intended. Five amendments to the act have rendered the legislation more workable on the ground, one of which in 1936 increased the authorized acreage in Federal grazing districts from

80 million to 142 million acres of vacant, unappropriated and unreserved lands. One of the more significant amendments in 1939 added to the act section 18, which gave legislative recognition to advisory boards of elected stockmen, together with appointed wildlife representation for each grazing district. This amendment established, in fact, for the first time in American history a democratic method for public land resource management with participation by industry and other interests in the undertaking.

The initial administration of the Taylor Act was carried on by the Division of Grazing, then a unit in the Office of the Secretary of the Interior. In 1939 the Division of Grazing was discontinued and administration of the public range vested in the Grazing Service of the Department of the Interior. On July 16, 1946, this Service was merged with the General Land Office to form the Bureau of Land Management.

The first job under the national conservation program was to bring about orderly grazing use of the public range. Progress toward this goal was made as apportionment of grazing privileges was accepted, founded upon qualified base properties. Nomadic livestock were either removed from the range or the homeless operators acquired properties to use as headquarter ranges. Adjustments in numbers and classes of livestock, and in seasons and areas of use were made continuously to confine grazing within several grazing capacity limits.

The actual management of the livestock on the range depends upon improvements necessary for distribution and seasonal migration. In 1935, through cooperation with the Civilian Conservation Corps, the Division of Grazing enlarged its scope of activities to include construction and related projects for the improvement and development of natural resources in grazing districts. Although many of the activities undertaken by the CCC forces were of an emergency nature such as fighting fires, rodents and other destructive elements, the work in general was developed according to carefully prepared plans for a long-time range improvement program. With the disbandment of the CCC the work has been continued as an integral part of the national range conservation program.

With the advent of World War II, our efforts were extended to attain the maximum output of food and other essential products from the Federal range while at the same time preserving the basic resources from which these commodities were obtained. While some increases in grazing privileges were granted by the issuance of war emergency licenses, we were careful to see that this increase was not inconsistent with the policy of sustained yield utilization of the forage resources.

With the abolishment of the CCC camps, certain equipment not considered vital to the military was retained on loan for fire protection use and the construction of access roads to strategic mineral deposits. Fourteen million acres of grazing district lands were used for military purposes during the war. Range improvement work was cut to bare essentials and confined principally to maintenance of existing projects.

Grazing administration in grazing districts during the 1947 fiscal year and to a lesser extent in 1948 was seriously restricted by appropriation limitations. During the 1947 fiscal year, the appropriation afforded only two graziers for each State. However, contributions from the industry made it possible to maintain a grazier for each district. The appropriation for 1948 provided sufficient funds for a district grazier and clerk for each district.

The Taylor Grazing Act was amended by Public Law No. 376, Eightieth Congress, to provide for a separate grazing fee and a range improvement fee. Following the amendment to the act, a supplementary appropriation of $300,000 was made by Congress. Appropriations for the coming year are still approximately $200,000 short of providing the organization recommended by Rex L. Nicholson in a special report to the Secretary of the Interior on public range administration problems. However, the increased appropriation for administration of the grazing lands and the increased allotment for soil and moisture conservation activities will add materially to the management, protection, and rehabilitation of the grazing lands in the West.

Meantime, areas of responsibility for the administration of section 15 lands have been added to existing grazing districts and we expect to provide more administration over these lands than has been afforded in the past.

As of June 30, 1948, the Bureau administered under section 3 of the Taylor Grazing Act the grazing on 151,707,449 acres of grazing district lands in 10 Western States as shown by the following table:

Area, in acres, of grazing-district lands, June 30, 1948

State	Number of districts	Vacant public lands [1]	Other lands	Total
Arizona	4	9, 763, 947	2, 509, 255	12, 273, 202
California	2	2, 903, 497	2, 351, 878	5, 255, 375
Colorado	8	7, 489, 310	764, 601	8, 253, 911
Idaho	5	12, 122, 192	570, 279	12, 692, 471
Montana	6	5, 234, 391	892, 884	6, 127, 275
Nevada	5	33, 668, 399	3, 407, 007	37, 075, 406
New Mexico	6	14, 266, 835	1, 973, 221	16, 240, 056
Oregon	6	12, 297, 528	708, 629	13, 006, 157
Utah	11	23, 648, 445	2, 394, 836	26, 043, 281
Wyoming	5	13, 503, 826	1, 236, 489	14, 740, 315
Total	58	134, 898, 370	[2] 16, 809, 079	151, 707, 449

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[1] Includes lands covered by rights-of-way, mining claims not of Federal record, and mineral withdrawals for classification.

[2] Includes 15,566,583 acres in withdrawals administered under agreement with other Federal agencies, 678,506 acres of private lands administered under cooperative agreements, and 563,990 acres of non-Federal lands leased under the Pierce Act.

In addition, a total of 12,210,992 acres of public domain lands outside of grazing districts were made available for grazing under 10,903 leases issued in accordance with provisions of section 15 of the Taylor Grazing Act. The total of these areas by States is shown by the following table:

Area in acres of land outside grazing districts leased under Sec. 15 of the Taylor Grazing Act as of June 30, 1948

States	Acres	States	Acres
Arizona	2, 232, 356. 46	New Mexico	460, 786. 63
Arkansas	1, 360. 00	North Dakota	55, 237. 94
California	2, 979, 797. 41	Oklahoma	7, 144. 08
Colorado	633, 285. 87	Oregon	543, 820. 17
Idaho	304, 260. 21	South Dakota	255, 533. 16
Kansas	1, 341. 79	Washington	374, 881. 31
Louisiana	40. 06	Wyoming	3, 093, 401. 60
Minnesota	17. 07		
Montana	1, 258, 931. 53	Total	12, 210, 992. 69
Nebraska	8, 797. 40		

Range Management Activities

There was an increase in trespass of livestock on the public lands during the 1948 fiscal year. District offices in some regions were flooded with complaints regarding trespass but were able to devote their attention to only the most flagrant cases. As a preventative measure, livestock were counted on trails and on allotments in some districts. Eighty-three trespass cases were settled by proposition of settlement. Two cases were referred to the Department of Justice for prosecution. An injunction was secured in Federal court restraining one operator from further trespass in New Mexico. One case was settled out of court and one is now on the docket to be tried in the very near future.

A total of 10,583 operators, 50 percent of the users of the Federal range within grazing districts, are using the public range under 10-year permits, and our objective is to issue these long-term permits to all operators who are qualified to receive them.

There were some 600 transfers of grazing privileges by sale or under the provisions of section 7 of the Federal Range Code during the past fiscal year. This is an indication that many ranch properties are still changing hands. A number of these transfers were the result of the breaking up of large ranch units into smaller units, although this trend was offset somewhat by the consolidation by smaller ranch units into medium sized units.

Considerable interest was shown in individual allotments, due to the belief that better range practices and better range development can be obtained with individual allotments.

A co-use agreement, providing for the administration of grazing by this Bureau on the Alamogordo bombing range, was worked out with the Departments of the Army and Air Corps. A co-use agreement was entered into with the Department of the Army whereby the Bureau will administer the grazing use on the Boardman bombing range in Oregon grazing district No. 7. A similar agreement was worked out with the Department of the Navy for the administration of the Arco proving grounds in Idaho grazing district No. 3.

Title III Bankhead-Jones Act lands in Montana, formerly administered by this Bureau under agreement of October 1, 1936, were returned to the Department of Agriculture for administration, and the agreement terminated insofar as it applied to the State of Montana.

Two military withdrawals in Arizona were revoked: The Yucca aerial gunnery range, 288,475 acres; and Camp Bouse training area, 336,386 acres. Several relatively small military target or camp sites in New Mexico have also been revoked.

Two districts in Oregon and two in New Mexico were consolidated in order to facilitate management. District 4, Oregon, was abolished and the area included in district 3. District 5, New Mexico, was abolished and the area included in district 4, New Mexico. Precincts in the consolidated districts were revised to provide equitable advisory board representation.

Some 12,000,000 acres in central Nevada are expected to be brought under administration during the 1949 fiscal year. Petitions have been received to add some 3,000,000 acres to Nevada grazing district Nos. 4 and 5.

Hearings

Hearings were held on 31 grazing appeals from decisions of the district graziers. Eighty appeals are pending hearings.

Range Studies

Range surveys and rechecks within grazing districts totaled 814,873 acres. The range survey made by the Department of Justice on a 4,000,000-acre area in western Colorado is being reviewed. The results of the survey have been checked in parts of Colorado grazing district No. 7 and the grazing capacities have been accepted as the basis for the limitation for grazing privileges in that district. Surveys were made of relatively small areas in all regions in connection with range controversies.

Squaw Butte Experiment Station, Burns, Oreg.

A large part of the time of the technical staff at the station was spent in completing the tabulation of back field data so that proper analysis and study can be made of these data. In June of this fiscal year, a resurvey of the range lands in the station was initiated. The data obtained on this survey will be checked against the inventory made in 1938 as a measure of vegetative composition and density changes which have taken place over a 10-year period. Two experienced range conservationists of the Soil and Moisture Conservation Branch were detailed to Squaw Butte for 2 weeks in June to assist with this project. A major portion of the station lands was covered with the assistance of the S. and M. conservationists, and the balance will be completed by range examiners employed at the station.

Livestock Production

In general, the peak seems to have been reached in recent trends in the industry to change the class of livestock from sheep to cattle. This is reflected in the increase in sheep numbers in all of the Western States with the exception of Montana, California, and Oregon. The over-all number of cattle increased by approximately 20,000 head, while sheep numbers increased by approximately 78,500 head over the 1947 fiscal year. For the same period, both horse and goat numbers decreased by approximately 5,000 head each. It is interesting to note, however, that while there was an increase in permitted numbers of livestock, there was a net decrease of approximately 267,000 animal unit months of use within grazing districts. This indicates that permittees are using the Federal range for a shorter period of time and are making more use of their privately owned or controlled lands. The number of licensed or permitted operators decreased from 20,960 to 20,845.

Following is a statistical table showing permitted and licensed livestock on the range in Federal grazing districts by States:

Number of permitted and licensed livestock within grazing districts, fiscal year 1948

State	Number of cattle	Number of horses	Number of sheep	Number of goats	Total livestock
Arizona	79, 312	1, 354	57, 845	4, 547	143, 058
California	92, 082	2, 956	135, 098	206	230, 342
Colorado	177, 739	4, 316	739, 375	164	921, 594
Idaho	243, 220	16, 166	960, 039	16	1, 219, 441
Montana	342, 014	19, 226	718, 624	40	1, 079, 904
Nevada	315, 371	9, 858	547, 150	361	872, 740
New Mexico	249, 772	12, 945	583, 574	31, 760	878, 051
Oregon	248, 116	11, 956	207, 990	----------	468, 062
Utah	192, 249	4, 950	1, 443, 706	3, 230	1, 644, 135
Wyoming	175, 386	9, 068	1, 231, 265	15	1, 415, 734
Total	2, 115, 261	92, 795	6, 624, 666	40, 339	8, 873, 061

Grazing-district fees collected during fiscal year 1948

State	Federal range	Other lands	Total
Arizona	$41,405.61	$1,176.95	$42,582.56
California	30,253.26	795.50	31,048.76
Colorado	81,501.91	1,241.82	82,743.73
Idaho	115,757.35	2,114.09	117,871.44
Montana	92,466.71	34,064.73	126,531.44
Nevada	184,881.71	826.17	185,707.88
New Mexico	158,435.07	609.86	159,044.93
Oregon	87,382.83	4,413.19	91,796.02
Utah	197,831.44	1,217.85	199,049.29
Wyoming	174,705.56	[1] 1,454.98	173,250.58
Total	1,164,621.45	45,005.18	1,209,626.63

[1] Minus adjustment in grazing fee collection on public domain and lands withdrawn for reclamation.

Wildlife Management

Accomplishment in wildlife management, on the whole, has been encouraging during 1948. Generally, good headway was made in all areas where the interested groups got together and dealt with the problem of wildlife management. This was especially true in the grazing districts where the district graziers set aside a scheduled time during advisory board meetings when other agencies and wildlife interests were invited to attend the meetings and take an active part in formulating wildlife management plans. At the first meeting of this kind held in Montana, those in attendance enthusiastically participated, and many requests were made to make the meeting an annual event. In some of the districts in Wyoming, some real gains were made and transplanting game from congested areas to less populated areas has been equally as important as game harvest in the grazing district management plans. In Utah, an Inter-Agency Big Game Committee meets in various parts of the State with local wildlife interests to develop proposals to be presented to the State Board of Big Game Control.

We expect to extend these types of meetings so that wildlife plans can be developed in cooperation with interested groups in all of the regions.

Estimates of the game animal population within grazing districts indicate an increase of approximately 60,000 head of big game animals, principally deer. This increase caused some concern in western Colorado, one district in Idaho, and two districts in Oregon. The problem is being studied and recommendations have been made to the State Fish and Game Commissions as to the number of deer which should be harvested in these areas to maintain a proper balance between big game and livestock without damage to the forage resources.

Estimated big-game population within grazing districts as of June 30, 1948

Deer	537, 327
Antelope	102,365
Elk	15, 797
Bighorn	[1] 3, 176
Javelina	710
Moose	410
Mountain goats	350
Buffalo	297
Bear	130
Total	660, 562

[1] Includes 849 mountain sheep.

Range Improvement

Range improvements, consisting primarily of water developments, fences, stock trails, bridges, etc., that have been placed on the Federal range, can be conservatively valued at $18,000,000. Some additional facilities were installed during the past fiscal year, but it is necessary because of our small appropriation for range improvements to stress the maintenance of existing projects and minimize the construction of new projects with range-improvement funds. Contributions, mainly in the form of labor and materials, by individual stockmen and advisory boards, supplemented our regular appropriation and to a large extent aided in the development program completed this year. As an example of the work that is being accomplished, the Nevada-California region reports the major part of their program is concentrated on three types of projects, namely, water developments, revegetation, and fencing. Eighty-eight new water developments were made, revegetation of 21,160 acres of Federal range which involved the reseeding of 11,900 acres, and the removal of heavy stands of sagebrush and blackbrush on 9,260 acres; 140 miles of drift fences constructed; projects maintained; 215 miles of truck trails, 224 miles of fence, 141 water developments; total project cost $157,500. Of this amount, $132,000 was contributed by the stockmen and the advisory boards. In addition to this, the stockmen expended $36,000 in the construction and maintenance of range improvements under section 4 permits.

A total of 526 section 4 permits were issued to livestock operators for the construction and maintenance of range improvements within grazing districts.

A summary of range improvements with accumulative totals are shown in the following table:

Range-improvement projects completed during fiscal year 1948

Type of project and unit of measurement	Range-improvement projects		Type of project and unit of measurement	Range-improvement projects	
	Outside grazing districts	Within grazing districts		Outside grazing districts	Within grazing districts
Boundary marking, miles		110	Reseeding, acres		1,130
Bridges, number		3	Reservoirs,[1] number	1	262
Cattle guards	1	13	Rodent control, acres	17,825	59,947
Corrals, number	2	13	Spring developments, number	1	32
Dams, number		1	Stock trails, miles		11
Ditches, feet		9,792	Storage tanks, number		2
Fences, miles	37	369	Telephone lines, miles		6
Firebreaks, miles		412	Truck trails, miles		125
Horses removed, number		2,500	Water troughs, number		2
Noxious weed control, acres		110	Wells,[1] number	1	27
Pipe lines, feet		29,178			

[1] Stock water.

Range improvement projects within grazing districts,[1] 1935–48

Type of project and unit of measurement	Completed or acquired Apr. 1, 1935–June 30, 1948	Type of project and unit of measurement	Completed or acquired Apr. 1, 1935–June 30, 1948
Boundary marking, miles	5,028	Reservoirs,[3] number	4,663
Bridges,[2] number	186	Spring developments, number	2,199
Cattle guards, number	810	Stock driveways, miles	1,487
Corrals and holding traps, number	486	Stock trails, miles	1 721
Ditches, miles	62	Telephone lines, miles	387
Fences, miles	8,528	Truck trails,[4] miles	11,088
Fire breaks, miles	4,983	Wells,[3] number	992
Pipe and tile lines, miles	78		

[1] Does not include data on brush removal; contour furrowing; dams, dipping vats; horse removal; noxious weed control; project inventories, appraisals, plans, and surveys; reseeding; road bars; rodent control; seed plots; storage tanks; water spreading; and water troughs.

[2] Over 20-foot span.

[3] Stock water.

[4] Includes mine-access roads.

Soil and Moisture Conservation Operations

The act of April 27, 1935 (49 Stat. 163), recognized soil erosion as a menace to the national welfare and provided for control and prevention of soil erosion, the preservation of natural resources, the protection of reservoirs, and the rehabilitation of the public lands. Reorganization Plan No. IV, dated April 11, 1940, transferred the activity of the Soil Conservation Service relating to soil and moisture conservation on Interior Department lands from the Department of Agriculture to the Department of the Interior. Soil and moisture conservation on grazing land is accomplished primarily by applying proper range management practices in connection with a planned program of structural improvements and revegetation.

The soil and moisture conservation program of this Bureau was seriously delayed in the early months of the fiscal year by circumstances over which the Bureau had no control. The House of Representatives in its report on the Interior Department Appropriation Act (No. 279, April 21, 1947) for 1948 announced the disallowance of the estimate of $1,290,000 for soil and moisture conservation operations on the public domain lands which are under the jurisdiction of the Bureau of Land Management.

Pursuant to this action and in preparation for the enforced dissolution of activities under this program as of June 30, 1947, notices were issued to all permanent employees on the soil and moisture roll which provided for their entering on annual leave on or before May 31, 1947, preliminary to separation from the service on or before June 30. Subsequently the Senate proposed a revision of the action by the House and the act as finally concurred in by the conferees from both Houses and signed by the President on July 25, 1947, opened the way for an allocation of $700,000, inclusive of $100,000 earmarked for aerial pellet reseeding work, to the Bureau for soil and moisture conservation functions during the 1948 fiscal year.

Organization

With the clearing of the appropriation steps were immediately taken to implement a new organization that had been devised to carry out the most vitally needed conservation practices on the public lands administered by the Bureau of Land Management. This new organization designed as a minimum for the effective and proper planning and processing of conservation operations is materially smaller than the combined soil and moisture organizations of the former General Land Office and Grazing Service, the two agencies which were responsible prior to July 1946 for soil and moisture work on the lands now administered by the Bureau of Land Management. The new organization is composed of 65 positions as compared to 95 positions in 1947, and 125 positions in fiscal year 1946.

The 1948 Program

In keeping with the principles and policies adopted by the Bureau of Land Management, project work during the year consisted of the application of simple, proven, and practical devices and treatments which have proven most effective in the rehabilitation of denuded and depleted range lands, and impeding of rapid run-off and the formation of destructive floods, and in reducing and preventing erosion of the soil. The scope of the soil-erosion problem is reflected in conservation surveys which indicate that active erosion has progressed to a serious-to-critical stage on one-half or about 96,000,000 acres of the public land in the continental United States administered by the Bureau. The allotment of $700,000 provided less than 1 cent per acre for the treatment of this vast area. No benefit to any of the land could be derived from the expenditure of these funds over the area as a whole. In the circumstances, it was considered advisable to limit operations to selected areas where it was believed the greatest possible good would be accomplished. The work performed benefited a total of only 2,701,000 acres situated in 153 out of a total of 298 approved project areas.

Pursuant to the requirement that $100,000 of the Bureau's allotment be expended for continued experimentation in range reseeding by the aerial pellet process, two projects were established, the Thorn Creek area in Idaho, and the Muskrat Creek area in Wyoming. Forty-three thousand acres were reseeded by this method.

One of the best examples of what can be accomplished with a reseeding program in conjunction with a good management program was reported by one of the district graziers in Nevada.

A 450-acre pasture was seeded to crested wheat grass in October 1945, by the use of a Wheatland-type disk to remove the sagebrush (Artemisia tridentata) and seeding attachments that broadcast the seed in one operation. The area was left unprotected until the fall of 1946, which resulted in considerable tramping and grazing during that time. A permanent 4-wire fence was constructed late in 1946 and grazing excluded until the summer of 1947 when it was grazed with 2-year-old steers at the rate of 4 acres per animal unit month. The season of grazing for 1947 was from mid-June until late July when most of the grass was dry and quite mature. The steer gains during this period were estimated at 2 pounds per day. Following this use, utilization checks were made and it was decided to use the area earlier the following season and at a higher rate of stocking. The grazing capacity of this area before treatment was estimated at 16 acres per AUM. In 1948 this pasture was grazed from late April to the middle of June by 2-year-old steers at the rate of 2.5 acres per AUM. Their daily gain was 2.39 pounds per day or 122 pounds per head during this period. The steers used in this test had been well wintered and were placed in the pasture in good condition. Had they been thin, the gains no doubt would have been much greater.

At current prices, the weight gains made in 1948 will more than offset the original cost of the project. This type of demonstration will no doubt have a definite influence on livestock operations and management and may change present methods to a point where every rancher may have a pasture of crested wheat grass to turn his steers on after they leave the feed lot in the spring. These steers would be shifted back to the meadows following hay harvest where they will continue to gain until shipped in the fall.

Several stockmen have indicated their interest in this type of operation. The University of Nevada is cooperating in this program and is keeping records of these operations.

In addition to the land treatment and structural projects processed during the year, a number of the older approved project areas were examined to determine the effectiveness of past work and the revisions of former conservation plans now found to be necessary in order to complete the rehabilitation of the depleted areas. Conservation plans were prepared also for a number of new problem areas.

All varieties of weather conditions were experienced, some harmful, others beneficial to the program. A serious drought prevailed in large areas in Arizona, California, Nevada, and New Mexico. Other areas and States received near-normal to above-normal precipitation. Unusually early and severe winter weather forced the closing down of project operations from 1 month to 6 weeks earlier than customary in Colorado and some of the other Rocky Mountain States. Benefit from good winter moisture in these same areas was largely dissipated by a prolonged cold, backward spring.

Range reseeding work, other than the pellet projects previously mentioned, was curtailed somewhat because of the extremely high costs of crested wheatgrass seed, the principal species used in this program. The reseeding work accomplished was quite adversely affected by cold, backward spring weather in some areas and by drouth in others, and a fair appraisal of the effectiveness of the work is not possible at this time.

Despite the delays and handicaps enumerated, a creditable showing was made in project accomplishments within and outside of grazing districts during the year as indicated in the following table:

Bureau of Land Management, soil and moisture conservation accomplishments, 1948

Projects	Unit of measurement	Within grazing districts	Outside grazing districts	Total
Revegetation:				
Reseeding—drilled and broadcast	Acre	28, 690	460	29, 150
Reseeding—aerial pelleted seed	do	43, 342		43, 342
Reseeding—aerial naked seed	do	13, 109		13, 109
Brush removal—suppression	do	22, 319		22, 319
Seed plots	Number	3		3
Conservation surveys:				
Project plans and surveys	Acres	1, 567, 211		1, 567, 211
Project inventory and appraisal	Number	12		12
Water conservation:				
Contouring	Acre	3, 200		3, 200
Dams, earthen	Number	11		11
Dams, check brush	do	120		120
Dams, spreader	do	12	16	28
Water spreaders, earth	do	4		4
Water spreading	Cubic yard	19, 953		19, 953
Road bars	Number	25		25
Diversion ditches	Linear feet	8, 976		8, 976

Bureau of Land Management, soil and moisture conservation accomplishments, 1948—Continued

Projects	Unit of measurement	Within grazing districts	Outside grazing districts	Total
Pest control: Rodent eradication	Acre	11,420	15,650	27,070
Stock water development:				
Pipelines	Linear feet	3,960	1,500	5,460
Reservoirs	Number	201	3	204
Springs	do	22	11	33
Stock tanks	do	2		2
Wells	do	20		20
Fences	Mile	153	57	210
Cattle guard	Number	14		14
Roads:				
Stock water hauling	Mile	18		18
Truck trail	do	15		15
Boundary posting	do	40		40

Active soil and moisture project areas, fiscal year 1948

	Within grazing districts	Outside grazing districts	Total
Region I	21	18	39
Region II	20	32	52
Region III	16	3	19
Region IV	18	7	25
Region V	13	5	18
Total	88	65	153

Cooperation

There is general interest and approval among private and State interests of the conservation program of the Bureau and the work has been greatly aided by the cooperation received from them. Many stockmen have undertaken, with some assistance from the Bureau, reseeding and other conservation work on the public and private land they use in their grazing operations. The aid received from different sources in the form of contributions of funds, materials, and use of equipment over the past 8 years has an estimated monetary value of $1,009,052. The assistance received in 1948 from various sources in the different States is shown in the following table:

Comparison of soil and moisture project expenditures with contributions from all sources

State	Soil and moisture	Range improvements	Contributions	Total
Arizona	$18,709		$13,945	$32,654
California	15,748	$2,201	4,155	22,104
Colorado	21,959	1,672	24,733	48,364
Idaho	109,956	1,221	9,211	120,388
Montana	13,284	576	5,255	19,115
Nevada	49,902	1,356	7,328	58,586
New Mexico	35,217		15,125	50,342
Oregon	33,712	657	8,324	42,693
Utah	48,083	1,901	15,513	65,497
Washington	1,822	665	2,885	5,372
Wyoming	83,752	1,729	5,486	90,967
Total	432,144	11,978	111,960	556,082

The Public Lands

AREA OF THE PUBLIC LANDS

The area of public lands remaining in Federal ownership, including Indian trust and tribal lands, as of June 30, 1948, amounted to about 413 million acres in the public-land States and about 365 million acres in Alaska. Approximately 436 million acres of these public lands were vacant, unappropriated, and unreserved as follows: 36 million acres in the States outside of Federal grazing districts; 135 million acres within such districts; and 265 million acres in Alaska. During the year 1,734,000 acres were withdrawn for various public purposes while withdrawals reserving 4,109,000 acres were revoked.

Of the approximately 778 million acres remaining in Federal ownership in the States and Alaska, 116 million acres in the States and 363 million acres in Alaska were still unsurveyed as of June 30, 1948.

The total acreage patented with minerals reserved to the United States was increased during the year to 49,360,106 acres as shown on the following table:

Acreage of lands patented with minerals reserved to the United States, as of June 30, 1948

Type of mineral reservation	Patented during fiscal year 1948	Total patented through June 1948
Reservation of all minerals:		
Under Stock Raising Act	4, 128	33, 603, 842
Under other acts	[1] 141, 768	[2] 2, 643, 724
Total all minerals	145, 896	36, 247, 566
Reservation of specific minerals:		
Coal	[3] 1, 695	[4] 10, 922, 147
Fissionable materials	59, 585	86, 584
Others	[5] 5, 988	[6] 2, 103, 809
Total specific minerals	67, 268	13, 112, 540
Grand total	213, 164	49, 360, 106

[1] Includes reservation of fissionable materials in 140,204 acres.
[2] Includes reservation of fissionable materials in 164,582 acres.
[3] Includes reservation of fissionable materials in 839 acres.
[4] Includes reservation of fissionable materials in 42,322 acres.
[5] Includes reservation of fissionable materials in 4,485 acres.
[6] Includes reservation of fissionable materials in 161,108 acres.

LEASES AND PERMITS

During the year the area under lease, including mineral permits and licenses, increased by 3,407,728 acres, making a total of 25,438,425 acres under lease at the end of the year. The types of leases in force June 30, 1948, are shown by the following tables:

Mineral leases, permits, and licenses outstanding, as of June 30, 1948

Mineral	Leases		Permits		Licenses		Total	
	Number	Acres	Number	Acres	Number	Acres	Number	Acres
Public lands:								
Oil and gas	[1] 13,438	10,702,700					13,438	10,702,700
Coal	341	85,833	59	72,141	57	2,225	457	160,199
Sodium	3	1,240	51	93,113			54	94,353
Phosphate	12	7,440					12	7,440
Potash	23	52,775	56	126,825			79	179,600
Silica sands	2	400					2	400
Quartz			1	1,364			1	1,364
Vanadium			2	189,440			2	189,440
Total public lands	13,819	10,850,388	169	482,883	57	2,225	14,045	11,335,496
Acquired lands:								
Oil and gas	205	218,211					205	218,211
Various minerals			88	37,121			88	37,121
Total acquired lands	205	218,211	88	37,121			293	255,332
Grand total	14,024	11,068,599	257	520,004	57	2,225	14,338	11,590,828

[1] Does not include 21 leases (9,566 acres) within naval reserves.

Leases other than mineral leases outstanding as of June 30, 1948

Type of lease	Number	Acres	Annual rental
Aviation	45	29,129.89	$530.00
Fur farm (Alaska)	8	61,412.00	350.00
Grazing (Alaska)	8	1,168,316.00	1,175.00
Grazing (Oregon and California)	253	320,012.74	10,779.58
Grazing (Taylor Act, sec. 15)	10,903	12,210,992.69	243,980.24
Recreational	17	20,058.56	[1] 615.70
Small tract	7,466	36,801.67	[2] 36,866.34
Water well	16	640.00	635.50
Others	3	233.71	1.00
Total	18,719	13,847,597.26	294,933.36

[1] Does not include the rental of 1 lease, the rental of which is based on receipts.
[2] Does not include the rental of 96 business-site leases, the rentals of which are based on receipts.

In addition, 400,000 acres were being used at the end of the year by Federal and local agencies, private individuals, and corporations under permit from the Bureau.

HOMESTEADS, SALES, AND OTHER ENTRIES

The following table shows the new entries and selections allowed, the entries finally approved, and the patents and certifications issued during the year. At the end of the year, 4,339 entries embracing 618,000 acres were pending awaiting further compliance with the public land laws by entrymen or final action by the Bureau.

Original entries and selections allowed, final entries approved, and patents and certifications issued, fiscal year 1948, by type of entry or selection

Type of entry or selection	Original entries and selections [1]		Final entries [1]		Patents and certifications [1]	
	Number	Acres	Number	Acres	Number	Acres
Homestead entries:						
Stockraising	1	640.00	7	4,042.17	7	4,127.51
Enlarged	10	2,760.00	1	200.00	7	1,424.07
Reclamation	[2] 204	24,360.08	[3] 57	6,229.11	113	11,085.36
Forest	------	------	2	67.94	------	------
Commuted	------	------	[4] 6	481.43	2	120.00
Sec. 2289, Rev. Stats., et al	474	57,974.37	[5] 95	9,555.07	72	6,176.30
Total homestead entries	689	85,734.45	168	20,575.72	201	22,933.24
Other entries and selections:						
Desert-land entries	56	7,159.01	14	1,733.04	19	2,652.32
Public auction sales	------	------	162	14,912.59	72	7,303.41
Timber and stone entries	------	------	2	80.00	2	80.00
Mineral entries	74	11,343.10	81	13,732.53	45	4,353.56
Indian selections	------	------	------	------	437	28.66
Miscellaneous cash-sale entries	(6)	(6)	[7] 205	4,868.56	190	3,950.68
Exchanges	------	------	------	------	207	208,541.42
State selections	30	12,408.35	------	------	5	[8] 29,875.10
Curative and supplemental patents	------	------	------	------	105	(9)
Other	1	7.64	5	67.38	59	7,106.25
Total other entries and selections	167	30,918.10	469	35,394.10	1,141	263,891.40
Grand total	856	116,652.55	637	55,969.82	1,342	286,824.64

[1] An original entry or selection is one made in pursuance of an act of the Congress which prescribes the terms and conditions under which patent may be issued or other evidence of title granted. An original entry becomes a final entry upon compliance by the entryman with further requirements of the law, such as residence or additional payment, and upon the issuance of a final certificate. A final certificate shows that, in the absence of irregularity, the entryman is entitled to a patent and passes equitable title to the land to the entryman. Where upon final examination it is found that an entry or selection is in proper form and that the law has been complied with, a patent conveying legal title to the claimant is issued. In the case of certain State selections, the legal title is conveyed upon approval thereof by the Secretary of the Interior and upon certification by the Director of the Bureau of Land Management.

[2] Includes 54 homesteads on ceded Indian lands (8,119.32 acres).

[3] Includes 5 homesteads on ceded Indian lands (468.30 acres).

[4] Includes 3 homesteads on ceded Indian lands (281.43 acres).

[5] Includes 16 homesteads on ceded Indian lands (1,172.85 acres).

[6] Town lots upon which only part payment was made (area not tabulated).

[7] Includes 33 ceded Indian town lots (area not tabulated).

[8] Includes certifications, 29,429.00 acres.

[9] Acreage previously reported.

LAND GRANTS

Title to 29,875 acres was conveyed during the year in satisfaction of grants of public lands made by the Congress to States for public purposes, including 21,184 acres of indemnity school land selections, 446 acres of swamp land, and 8,245 acres for support of miners' hospitals. Other grants included 4,760 acres to the Reconstruction Finance Corporation, 1,320 acres for an airport, 686 acres to railroad corporations, and 8 acres to a hospital.

LAND EXCHANGES

Exchanges of land with private owners and local governments resulted in the addition of 177,594 acres to grazing districts in exchange for 152,215 acres of Federal land; 16,163 acres to Indian reservations in exchange for 19,080 acres; 9,248 acres to the "O and C" lands in exchange for 3,213 acres; 1 acre to a national park in exchange for an equal acreage; and 288,378 acres to national forests in exchange for 33,069 acres of land and sufficient timber to equalize the values involved. In addition, the Government accepted 964 acres in exchange for an equal acreage conveyed for addition to a State park.

RECEIPTS AND EXPENDITURES

Receipts from all sources during the year totaled $33,286,434.23. Mineral rentals, royalties, and bonuses accounted for 80 percent of the total receipts and sales of timber from the Oregon and California and Coos Bay lands for an additional 14 percent. Grazing activities under the Taylor Grazing Act yielded 4 percent while the remaining 2 percent were realized from sales of public and ceded Indian lands, rentals, fines and penalties, copying fees, and from miscellaneous sources.

Of the total receipts, 36 percent will be distributed by the Bureau among various State and county governments and 41 percent will be covered into reclamation funds. Of the remainder, $17,585.68 will be credited to Indian trust funds, $349,957.87 will be credited to the range improvement funds, and $467,225 will be transferred to the Department of Agriculture for disposition.

Expenditures from appropriations amounted to $4,540,678. Expenditures, aggregating $1,251,489, were made from funds transferred to the Bureau for: disposal of surplus real property, $90,095; Missouri River Basin project, $338,287; soil and moisture conservation operations, $708,548; white pine blister rust control, $88,610; naval ordnance test station, $5,751; access roads, $420; reclamation projects, $18,980; and legal research, $798.

The following table shows the receipts earned during the year, by sources and Treasury accounts:

Distribution of receipts of the Bureau of Land Management,[1] fiscal year 1948

Source of receipts	Covered into the Treasury earmarked for—				
	Indian trust funds	Reclamation funds	States and counties	Other funds	Total
Mineral leases and permits:					
Mineral Leasing Act		$12,784,290.52	$9,131,636.08	$2,435,102.96	$24,351,029.56
Red River oil and gas lands	$5,655.36		3,393.27		9,048.63
Potash		[2] 649,822.41	405,438.96	108,117.06	1,163,378.43
Acquired lands				431,036.30	431,036.30
Other				[3] 585,050.88	585,050.88
Total mineral	5,655.36	13,434,112.93	9,540,468.31	3,559,307.20	26,539,543.80

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[1] Before final settlement of all accounts by the General Accounting Office.

[2] Includes $82,207.86 collected in California under act of Oct. 2, 1917 (40 Stat. 297).

[3] Includes $41,467.28 collected in Wyoming under act of June 26, 1926 (44 Stat. 1621), $305,983.53 collected in California under Executive Order 9087, dated Mar. 5, 1942, $29,801.92 collected in Alaska, and $207,798.15 collected in Louisiana under Executive Order 9632, dated Sept. 28, 1945.

Distribution of receipts of the Bureau of Land Management, fiscal year 1948—Continued

Cource of receipts	Covered into the Treasusy earmarked for—				
	Indian trust funds	Reclamation funds	Stater and counties	Other funds	Total
Sales of public lands		158, 318. 21	9, 703. 07	84, 077. 89	252, 099. 17
Fees and commissions		144, 925. 14		6, 522. 50	151, 447. 64
Oregon and California grant lands			2, 206, 901. 05	2, 206, 901. 05	4, 413, 802. 10
Coos Bay grant lands			25, 000. 00	228, 064. 31	253, 064. 31
Taylor Act grazing leases	3, 704. 59		120, 003. 75	[4] 120, 003. 76	243, 712. 10
Taylor Act grazing-district fees	491. 15	2, 492. 26	136, 960. 66	[5] 1, 069, 682. 56	1, 209, 626. 63
Rights-of-way		3, 832. 70		34, 173. 27	38, 005. 97
Sales of reclamation lands		1, 272. 76			1, 272. 76
Sales of Indian lands	7, 734. 58				7, 734. 58
Copying fees				5, 232. 80	5, 232. 80
Miscellaneous leases and permits				79, 486. 83	79, 486. 83
Other				91, 405. 54	91, 405. 54
Grand total	17, 585. 68	13, 744, 954. 00	12, 039, 036. 84	7, 484, 857. 71	33, 286, 434. 23

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[4] Includes $60,001.88 for the range improvement fund (outside of grazing districts).

[5] Includes $289,955.99 for the range improvement fund (grazing districts) and $36,188.70 for the Department of Agriculture.

Fish and Wildlife Service

Albert M. Day, *Director*

THE use of our wildlife resources for recreational purposes, which increased so sharply immediately after World War II, shows no sign of diminishing and continues to tax the capacities of conservationists to maintain the resources. So also the uneasy condition of the world, with populations generally in severe imbalance with their food supplies, has emphasized the essential quality of efforts to develop and sustain the great food reserves of the ocean and the land.

The basic resources of soil, water, forests, and wildlife have suffered long and world-wide abuse. Examples of their destruction have become so numerous and so dramatic in their impact on human affairs, that there seems to be an awakening of public awareness of these fundamentals of conservation: First, that the natural resources of the earth are interrelated and dependent, one upon another, so that no one can be conserved without the conservation of all; and second, that conservation, to be effective, cannot be treated as a series of local unrelated problems, but must be coordinated over wide geographic areas.

In the actual tasks of conservation and also in the studies which provide the foundation on which it rests, there are encouraging signs of a closer degree of cooperation. In universities and other research institutions there is a marked tendency to initiate or expand programs or investigations which have direct application to resource conservation, and to coordinate these programs with State and Federal conservation agencies. Extremely desirable as this situation is, it has served to accentuate the shortage of competent research men and technicians, the scarcity of which in several fields has become acute.

All of the 48 States are now participating in wildlife restoration projects, cooperatively with the Federal Government. Through the program of cooperation with American Republics, there is, on a larger scale than ever before, a pooling of information on the fishery and wildlife resources of the Western Hemisphere, and a more widespread application of the techniques of conservation. The existing international treaties for the management and conservation of resources shared by several countries have been, on the whole, so successful that several additional treaties may be negotiated for the cooperative restoration and development of other international resources.

The most vigorous prosecution of these and related efforts will be required if the American public is to continue to enjoy the benefits of its wildlife resources. The activities of the Fish and Wildlife Service in 1948 reflect the varied and challenging nature of the task of maintaining this segment of our national wealth.

Marine Fishery Research

About 95 percent of the United States production of fish and shellfish consists of marine species. These great ocean fisheries, based on many different species, all interrelated and affected by the changing marine environment, demand a continuing program of observation and research, if they are to be efficiently managed and profitably utilized.

On the Pacific coast the important pilchard fishery suffered its third successive season of disastrously low catches. The 1947–48 season produced the lowest tonnage landed since 1923–24. There were virtually no landings at San Francisco, relatively few at Monterey, and the catch at San Pedro was below normal. The total catch for the State of California was only 110,000 tons. The situation was no better in the Pacific Northwest, where less than 9,000 tons were landed. The abrupt decline in landings appeared, on the basis of research conducted by the Service since 1937, to be the result of two factors: Poor production and survival of the fish during the years 1940 through 1945, and a possible change in the habit pattern of the pilchards, making the fish less available.

Age composition of the 1947–48 catch, based on work done in cooperation with the State of California, shows that the catch made in the Pacific Northwest was composed predominantly of old fish, while in the landings of southern waters the young 1946-year class appears moderately dominant. The survival of immature pilchards was studied in 1947 to gain information on factors that influence abundance. Collections were made of pilchard eggs and larvae off southern California and meteorological and hydrographic records of the Pacific coast were assembled. The data will be analyzed to find what correlation exists between the abundance of eggs and larvae and conditions in the sea.

A plan for a cooperative program for study of the failure of the pilchard fishery has been formulated in cooperation with the Scripps Institute of Oceanography and the California Division of Fish and Game. The Service's participation in this program may include extensive work on one or more vessels at sea to study causes of the fluctuation in the survival of young pilchards.

The effect of atom-bomb explosions on fish was studied during July and August 1947 by biologists of the Fish and Wildlife Service with the Bikini scientific research group. The catch of 692 fish of 18 different species was almost identical with that obtained in 1946.

The Pacific tunas, which are among our most valuable fishes, have been investigated in order to obtain preliminary information on their life history, abundance, and distribution. Postlarval and juvenile specimens of yellowfin tuna, oceanic skipjack, black skipjack, and mackerel were found off the coast of Central America, indicating that spawning occurs near this locality. Exploratory studies in the South Pacific were conducted to collect information on the distribution of the tuna, their availability to commercial fishermen, and the presence of fish suitable for use as live bait. A few tunas were taken by trawling from the motorship *Alaska* but no schools were encountered that could be taken by seine. Through studies made in the vicinity of the Pacific islands, silversides were found to be abundant at a number of places and these potential bait-fish survived in tanks provided with circulating water.

The *Albatross III*, a vessel commissioned this year for marine research, has greatly facilitated work on the North Atlantic fishing banks. Most important have been the studies in the use of a large-mesh cod end in otter trawl fishing for haddock, cod, and other fish. During the calendar year 1947 at least 17,000,000 young haddock were caught and discarded on the New England banks by the otter trawl fleet. If these fish had been allowed to survive until 1948, the industry would have had an additional 30,400,000 pounds of good-sized haddock worth about $3,000,000. In our studies, young haddock which passed through the recommended large mesh were caught in a fine-mesh covering, brought to the surface, tagged and released. Their returns will indicate the survival of these immature fish which are taken by the trawl and passed through the larger-sized mesh.

The investigations on rosefish in northern New England continued through 1947. It has been found by a study of abundance of mature and immature fish that the recruitment of young fish between 1942 and 1946 was constant but that the abundance of the large, mature fish dropped almost 40 percent.

The shad once supported the most important fishery on the Atlantic coast. Between 1896 and 1930 this fishery experienced a decrease of over 79 percent; at present prices, this would represent a loss of $8,000,000. Although in recent years the shad populations in both the Hudson and Connecticut Rivers have furnished a greater production than at any time since 1880, the majority of the rivers are still badly depleted. Studies on trends in abundance, determination of the composition of the spawning stock, and collection of other basic information have been continued. On August 28, 1947, 236 shad were tagged from 2 schools off Mount Desert Rock in Maine. Twenty of the tagged shad have been recovered from rivers in Georgia and North Carolina, in Chesapeake Bay, and in the Hudson and Connecticut Rivers, indicating that adult shad from the widely separated rivers congregated in mixed schools in the sea to feed. This means that shad conservation cannot be considered a local problem.

An active program of shellfishery research continues. In Chesapeake Bay particular attention has been given to investigations leading to the development of oyster-seed areas; as a result of studies made, greater utilization of two previously discovered grounds is possible. In order to aid oystermen who wish to move oysters from water of one salt content to that of another, research has been done on the reaction of oysters to lowered salinity. Studies are also being carried on for the purpose of improving the methods of fattening oysters.

Oyster spawning and setting were the subjects of extensive studies in Long Island Sound. Information on these subjects of vital interest to oystermen was released through a series of bulletins issued during the season.

Since development of oyster larvae is of prime importance to oyster growers, extensive laboratory studies are being made of the effect of variations in temperature, salinity, and other environmental factors on this process. Rate of growth of oysters also was studied, particularly in Milford Harbor, Conn.

Growing oysters are beset by many natural enemies, such as starfish, boring sponges, and drills; research can aid oystermen in minimizing the depredations of these enemies. Periodic surveys were made by the Service on Connecticut oyster beds for the purpose of locating concentrations of starfish, and oystermen were informed of the location of these concentrations.

The Conservation of Alaska Fisheries

Since the Fish and Wildlife Service is charged with the direct control of Alaska fisheries, continuous scientific observation of the various fish populations is maintained for the purpose of formulating adequate and effective regulations.

The great red salmon runs of Bristol Bay and Kodiak Island must be maintained if Alaska's fishery production is to be kept at favorable levels. Research for management of these resources included spawning-ground surveys and studies of fresh-water organisms in lakes. Because the red salmon spend the early years of their lives feeding in lakes, information on food organisms and nutrients in the water is valuable in devising means to improve juvenile growth and survival. Feeding of bears on red salmon at Kodiak Island appears to be an important factor in mortality, and the problem is being studied with a view to instituting control measures.

Southeastern Alaska pink salmon continue to rank high in the Territory's production of food fish in spite of relatively low packs in recent years. In 1947, it was necessary to delay the opening of the season from 2 weeks to a month later than in 1946 in all districts of southeastern Alaska.

Studies at Little Port Walter, where both upstream and downstream migrating fish are counted, show that survival of pink salmon in the streams is highly variable and that the most important factors influencing it are water levels and climatological conditions. A large number of pink-salmon streams have been surveyed with a view to making passable some of the natural barriers, such as waterfalls, that obstruct the migration of the salmon. It has been found that the construction of fishways in certain streams would result in a substantial improvement of conditions favoring increased runs.

Alaska herring production is continuing at a high level under scientific management of the catch.

A total of 61,447 fur-seal skins were taken at the Pribilof Islands in 1947, compared with 64,523 in 1946. At the close of sealing operations the census enumeration of the herd indicated that it had increased in size to 3,613,653 animals.

Scientists investigating problems of fur-seal management on the Pribilof Islands have tagged nearly 20,000 seal pups, and have made two extensive cruises in north Pacific waters in the motorship *Black Douglas*, gathering information on the migration routes and food habits of the fur seal.

Recoveries of the tagged seals at sea during the coming years will yield specific information on the migration habits. In 1950, when the pups will be ready for killing, a statistical study of the recoveries of marked 3-year-olds on the killing grounds will make possible a check on the accuracy of seal censuses by other methods.

Salmon Conservation in the United States

The major problems of salmon conservation in the Western States continue to be related to the construction and operation of water-use projects by the Corps of Engineers and the Bureau of Reclamation. McNary Dam, the huge Columbia River structure now under construction near Umatilla, Oreg., engages a large part of the attention of biologists studying means to protect the salmon of the Columbia River. Experiments at Bonneville Dam yield knowledge which can be applied in protecting fish at McNary. For instance, extensive operation of special fyke nets has revealed that downstream migrating salmon are distributed uniformly in the river, with the result that the numbers of fingerlings passing through turbines, fishways, and spillways are proportional to the amount of water going through each of these passages. This means that, if possible, methods should be devised to attract the young fish to safe passages. Moving lights and underwater sound are being experimented with to this end. Analysis of marking experiments at Bonneville Dam, in which identical lots of distinctively marked young salmon were released both above and below the dam, indicates that the average mortality (or loss) of downstream migrating fish at the dam is approximately 14 percent. Since McNary Dam will be higher than Bonneville, greater losses may be expected there, and the importance of adequate fish protective measures is increased.

Since McNary Dam and other proposed river constructions endanger the salmon spawning areas of the upper Columbia Basin, it is important to develop to the fullest extent possible the tributaries lying below these dams. From intensive studies and surveys a program, known as the "Lower River Plan" has been developed. It includes the following measures: Removing obstructions in the lower Columbia tributaries to permit free migration of fish, abatement of pollution in tributary waters, screening all diversions, transplanting upriver salmon runs to suitable spawning areas on lower Columbia tributaries, establishing fish refuges where the needs of salmon conservation would have precedence over other uses, and extending artificial propagation.

The intensive conservation program carried out in the middle Columbia Basin, to counteract the effects of Grand Coulee Dam, has been successful. This program combined the transplanting of runs to tributaries below the dam for natural spawning and a considerable expansion of activities in artificial propagation. The success of the program was indicated by the extremely large runs of salmon in 1947, especially of the bluebacks and the fall chinook salmon. However, the addition of new dams below the site of these operations may be expected to impair the middle Columbia runs, making necessary the attempt to improve the lower Columbia Basin as the last stronghold for the great runs of this river.

Investigations of salmon in streams of California's Central Valley continue to provide the basis for effective maintenance of the fishery resources of the area. Studies of the biology of fish in the Delta region of the Sacramento River indicated the types of fish-protective devices needed at the Bureau of Reclamation's Delta Cross Channel and Delta-Mendota pumping plant, and appropriate recommendations have been made. A preliminary survey revealed the large extent of the sport fishery of the Sacramento in which over 3,000 salmon and almost 4,000 steelhead trout were taken by anglers.

The Atlantic salmon has long been an important fish in New England but its abundance has declined to extremely low levels in recent years. The Fish and Wildlife Service has entered into a cooperative agreement with the Atlantic Sea-Run Salmon Commission and several agencies of the State of Maine, to carry out a program for the restoration of the runs. For several years salmon have been hatched and reared at the Service's Craig Brook hatchery in Maine. Most of these fish were marked before planting. The return, in 1947, of the first marked fish from the sea resulted in greatly increased interest in this program.

Utilization of Fishery Resources

The Fish and Wildlife Service conducts research and maintains services that assist the fishery industries and consumers in obtaining the greatest possible return from our fishery resources. These include technological, marketing, economic, educational, and statistical research and services.

Under existing methods, an enormous wastage of potentially valuable material occurs in many fishing and processing operations. For example, it is estimated that more than 100,000,000 pounds of waste is discarded annually by salmon canneries in Alaska. Certain conditions peculiar to the industry make it impracticable to convert this waste into meal and oil. Research is being carried out intensively to develop some practicable and feasible use. The recovery of certain chemicals useful in the food, cosmetic, and pharmaceutical industries appears most promising.

Utilization of the butter-clam resources of southeastern Alaska has been seriously hampered by evidence of seasonal toxicity of the clams. Experiments are being made to define more clearly the seasons of toxicity and areas where affected clams occur, also to determine means of destroying the toxin.

Service personnel have been detailed as consultants and observers aboard vessels freezing fish in Pacific waters. A method of improving the quality of fish landed for filleting has been under preliminary study. If this method of handling proves feasible in commercial practice, it will not only enable a higher proportion of good quality fish to be brought to port but will also permit the boats to remain on the fishing grounds for longer periods.

General technological studies have been carried out to determine factors affecting extraction of vitamin A from fish livers, factors affecting stability of vitamin A both in stored livers and in extracted oils, and conditions controlling retention of texture and flavor during freezer storage of fish.

The rising price level and general inflationary tendencies highlighted events in the field of fishery economics during the past year, and required the collection of comprehensive data on past and present conditions with respect to the production, distribution, consumption, and prices of fishery products. This information was made freely available to Members of Congress, industry, and all interested persons.

During the year fishery products were generally in good demand, partly because of the meat situation. The Service and the various trade organizations undertook to acquaint more housewives with methods of fish cookery and with the wide variety of fishery products available. Lack of this knowledge retarded the sharp increase in the consumption of fishery products that otherwise would have been brought about by supply conditions of other foods. The industry responded to consumer interest with sustained production. However, heavy imports in the winter and spring competed seriously with domestic products, particularly in the field of frozen fillets.

Market development activities were aimed at improving both immediate and long-range situations. The Department of Agriculture was informed each month as to the supply situation in fishery products, as were the various trade journals. Closer relations among the trade and easier access to sources of supply were promoted by the circulation of a list of wholesale dealers operating in inland areas. Similarly, the Service maintained lists of refrigerated locker plants for the use of the trade in developing further outlets for fishery products.

A motion picture portraying advanced practices in fish retailing, produced by the Fish and Wildlife Service, has been widely used in meetings of retailers sponsored by the grocery and fishery trades and at meetings conducted by the Service. Other educational motion pictures prepared or in preparation as aids to industry and in the promotion of fishery products include Basic Net Mending, a film dealing with the catching, processing, and marketing of east coast sardines, and a documentary film covering the North Pacific Halibut fishery.

Home economists of the Service conducted numerous fish cookery demonstrations before important national trade associations and large groups of home economics classes in colleges in various cities of the United States. These demonstrations have stressed new ways to prepare and serve fish and shellfish and the nutritive value of the many varieties.

The collection of statistics was one of the earliest activities of the Federal Government in relation to the fisheries and the supplying of these data has continued to be an important function of the Service.

General statistical surveys in 1948 covered each of the coastal States except those in the South Atlantic and Gulf areas, and included information on the volume and value of the catch by species, gear used, and locality of capture. For most States the surveys also covered the number of fishermen engaged in the capture of fishery products, the number of fishing craft operated, and the quantity of gear used.

The Service continued publication of the monthly bulletins containing data on the landings of fishery products in Maine and at the principal Massachusetts ports, as well as publication of statistics on domestic freezings of fishery products and holdings of frozen fish and shellfish, fish meal and oil, canned fishery products, byproducts, and packaged fish.

The Fishery Market News Service during fiscal year 1948 operated six field offices, at Boston, Mass.; New York City; New Orleans, La.; Chicago, Ill.; Seattle, Wash.; and San Pedro, Calif. With the closing of the Hampton, Va., and Jacksonville, Fla., offices at the end of the fiscal year 1947, collection of market information on fishery products in the South Atlantic and Chesapeake Bay States was discontinued except in the vicinity of Norfolk, Va., where some reporting of landings was carried on. Better coverage of the important shrimp industry has been provided, reports now including imports in the Gulf States. Because inspection by the Food and Drug Administration now covers less than 50 percent of the shrimp canning plants, the Market News Service has been extended to cover the pack of shrimp (and also of oysters and crab meat) in the South Atlantic and Gulf States.

Reporting services on production, prices, cold-storage freezings and holdings, and movement of fishery products were improved in the Market News Offices operated and the coverage of the San Pedro office was extended to include Eureka, Calif.

Maintaining the Inland Fisheries

Hatcheries play an important part in supplying fish for inland waters. The Service is endeavoring through research to improve their efficiency, giving particular attention to problems of disease control, nutrition, and hatchery procedure.

Some of the new disinfectants promise to be useful in controlling diseases of hatchery fish, among them pyridylmercuric acetate. Service laboratories are now testing several such disinfectants, as well as continuing experiments in the use of various sulfa compounds in treating trout for the serious disease, furunculosis.

The construction of new hatcheries in some areas and the scarcity of some food supplies have created serious hatchery feeding problems which are being met by basic research on the nutritional requirements of hatchery fish. In western hatcheries the utility of dry meals as supplements to fish diets was tested, and the results of feeding rockfish carcasses, whole rockfish, and salmon viscera were noted. At Cortland, N. Y., an extensive study was made of the vitamin requirement of trout; brook, brown, and rainbow trouts were found to have similar requirements for niacin and these were independent of water temperature. The addition of cod liver oil to the diet was demonstrated to be beneficial for brook trout. Experiments at Leetown, W. Va., showed that in rainbow trout feeding white fish meal and dried yeast were notable for growth production.

Numerous research projects were carried on for the development of new fish propagation techniques. Physiological studies upon fish indicated that flow is more important than volume in utilizing a hatchery water supply. Experiments at the Leavenworth, Wash., hatchery indicate that round ponds have a 50 percent greater carrying capacity than another type now in use. The increasing cost of materials and labor used in hatchery construction makes it desirable to reduce the size of hatchery buildings wherever possible. In order to make such a reduction a special hatching device, consisting of a vertical hatching cabinet, has been devised. It not only occupies but a fraction of the floor space required for the conventional horizontal trough, but also has the advantage of simplicity of operation.

Many of our inland waters are located within the boundaries of areas (such as forests and orchards) which are sprayed for insect control with DDT and other recently developed compounds. To avoid undue losses of fish, field studies are being made to determine the effect on fish of various concentrations of these insecticides. Experiments with DDT sprays in streams in Virginia and West Virginia showed that more fish were killed by oil spray than by suspension spray. An application of 1 pound per acre of oil spray was demonstrated to be dangerous to fish and very destructive to aquatic insects, many of which are important fish foods. Some of the other insecticides were found to be highly toxic. That of highest toxicity (toxaphene) killed all fish when applied at the rate of one-fourth pound per acre.

In the Great Lakes, where the sea lamprey pest has made serious inroads on the populations of commercially valuable fish, an active program of study is under way for the purpose of developing control methods. In Lake Michigan relatively few lake trout less than 20 inches long, but nearly all those 28 inches or longer, bear lamprey marks. A contract has been let for the construction of an experimental weir on a tributary to Lake Huron. Besides the work on the sea lamprey program, basic studies on the life histories and statistics of important Great Lakes fishes are being continued.

In the 97 fish hatcheries now operated by the Service, primary emphasis is on the following objectives:

(*a*) Fish cultural stations on the Pacific coast are concerned chiefly with the maintenance of salmon runs in coastal waters.

(*b*) In trout stations emphasis is upon the production of larger fish (in some areas, legal size) with stocking linked as closely as possible with State programs. The Service is making strong efforts to provide trout to stock waters on Federal lands. Present hatchery facilities need enlargement and modernization if increased demands are to be met.

(*c*) Hatcheries producing warm-water species such as bass and sunfish are supplying large quantities of fish for stocking farm ponds, especially in the South Central States, but increasingly also in other areas. Since these ponds can be stocked successfully with very small, "seed" fish, the hatcheries are operated to produce maximum numbers of small fish, in contrast to the objectives of the trout hatcheries. Experiments to improve efficiency of warm-water fish production are being conducted.

(*d*) While hatchery production of commercial fish species is limited, the propagation of shad was resumed at Fort Belvoir, Va., during 1948. Striped bass also were hatched cooperatively with the State of North Carolina.

(*e*) A program for the propagation of fresh-water mussels was inaugurated at the Crab Orchard National Wildlife Refuge, Cartersville, Ill.

TABLE 1.—*Summary of the production of fishes and eggs by Federal hatcheries during the year ended Dec. 31, 1947*

Group	Eggs	Fry	Fingerlings or larger	Total
Catfish			374, 361	374, 361
Channel catfish		130, 750	137, 893	268, 643
Yellow catfish			4, 185	4, 185
Buffalofish	152, 250, 000		10, 500	152, 260, 500
Shad		14, 311, 000	1, 500	14, 312, 500
Striped bass		7, 756, 000		7, 756, 000
Atlantic salmon			150, 281	150, 281
Chinook salmon	8, 970, 500	26, 851, 750	31, 136, 140	66, 958, 390
Chum salmon		8, 021, 440		8, 021, 440
Silver salmon			1, 775, 865	1, 775, 865
Sockeye salmon	10, 432		4, 073, 983	4, 084, 415
Landlocked salmon	1, 052		30, 801	31, 853
Steelhead trout			263, 291	263, 291
Rainbow trout	11, 774, 421	207, 650	6, 019, 015	18, 001, 086
Cutthroat trout	14, 470, 934	3, 896, 540	2, 595, 919	20, 963, 393
Loch Leven or brown trout	2, 275, 422	75, 860	1, 844, 464	4, 195, 746
Lake trout	10, 826	108, 100	509, 153	628, 079
Brook trout	11, 754, 276	903, 987	4, 224, 066	16, 882, 329
Grayling	2, 078, 608		48, 154	2, 126, 762
Pike and pickerel	6, 070, 988	13, 250, 597	68, 680	19, 390, 265
Crappie			270, 857	270, 857
Largemouth black bass		2, 031, 848	5, 717, 480	7, 749, 328
Smallmouth black bass		851, 000	196, 309	1, 047, 309
Rock bass			14, 177	14, 177
Warmouth bass			20, 368	20, 368
Bluegill			34, 536, 584	34, 536, 584
Green sunfish			56, 500	56, 500
Red-eared sunfish			490, 383	490, 383
Yellow perch			33, 521	33, 521
White perch		1, 950, 000		1, 950, 000
Cod	87, 600, 000			87, 600, 000
Haddock	27, 200, 000			27, 200, 000
Flounder		1, 136, 737, 865		1, 136, 737, 865
Pollock	1, 021, 934, 000			1, 021, 934, 000
Lobster		1, 164, 300		1, 164, 300
Terrapin			7, 000	7, 000
Total	1, 346, 401, 459	1, 218, 248, 687	94, 611, 430	2, 659, 261, 576

Cooperation With American Republics

The Interdepartmental Committee on Scientific and Cultural Cooperation was created by the President in May 1938 to facilitate the solution of problems of common interest to the peoples of the American Republics. The Congress, through enactments in 1939, authorized the conduct of cooperative programs and the exchange of technical specialties. The program of the committee, financed by the annual Department of State appropriation, "Cooperation with American Republics," and carried out by numerous Federal agencies, is a practical, realistic plan of cooperative action through exchange of information, skills, and knowledge which will assist in intellectual growth, in the spread of information and techniques, in the handling of social and economic problems, and in the increase of understanding among peoples.

Continuation of the fishery mission to Mexico in fiscal year 1948 was fully justified by the outstanding success of the mission in earlier years. Mexico and the United States have many fishery interests and problems in common, both in the Gulf of Mexico and along the Pacific coast of the continent. Roughly three-fourths of the Mexican catch of fishery products and those taken off the Mexican coasts are exported to the United States or transported there in American fishing vessels.

Because of these common interests, it is the function of the Mexican fishery mission to assist both countries to uncover facts pertaining to the little-known fishery resources of Mexico, to assist Mexico in training a competent staff of fishery investigators, and to bring about a better understanding and closer cooperation between the two countries with respect to the conservation and optimum utilization of the fisheries.

The report of the technical mission to Guatemala, carried on in parts of 1946 and 1947, was completed in June 1948. An inventory was made of the natural biological resources of the country, and an integrated plan formulated for the administration, development, utilization, and conservation of the fishery and wildlife resources to serve as the basis for further development of a conservation program by the appropriate and fully authorized agencies of the Government of Guatemala.

As a direct outgrowth of a mission to study the salt-fish industry of Venezuela in 1943, the Venezuelan Government, in 1947, requested the active cooperation of the Fish and Wildlife Service in a more extensive and long-continued survey. Accordingly, an aquatic biologist was assigned early in 1948 to a year-long investigation of the marine fisheries of that country. All expenses of the survey will be met by the Government of Venezuela. To facilitate the investigation, the Government of Venezuela purchased a vessel in the United States and fitted it especially for the purposes of experimental fishing. Although the study will be directed at a diversity of forms, including shrimp, Spanish mackerel, bonito, tuna, pompanos, bluefish, flounders, snappers, and groupers, special attention will be given to the sardine.

At the request of the Government of Panama, the Fish and Wildlife Service, in January 1948, assigned a specialist in the biology of shellfish to an investigation of the pearl oyster resources of Panama. All costs of the study were borne by the Panamanian Government. For some time, there had been a decline in the pearl oyster industry, and it is generally believed that the oysters have been adversely affected by disease. The American expert made an exhaustive inquiry, over a period of 2 months, into the physical, chemical, and biological factors which may influence the oysters. Prior to his return to the United States, he made a brief visit to Venezuela to conduct a preliminary survey of the oyster resources of the Margarita region.

On the invitation of the Cuban Government, the Fish and Wildlife Service, in February 1948, assigned a party of three ornithologists to a 2-months' survey of the migratory bird fauna of Cuba. Many species of birds which spend the summer in continental United States winter in Cuba, or pass through that country during the spring and autumn migrations. To permit proper conservation of this valuable biological resource, it is essential to have a detailed knowledge of the birds and their environment throughout the geographical range, hence, the United States, as well as Cuba, is concerned with the outcome of the investigation.

The Fish and Wildlife Service continued its program of in-service training grants which provides opportunities to qualified students from American Republics to receive training and experience in several phases of fishery science and wildlife management. During the fiscal year 1948, 10 students were in training in the United States: 2 from each of Brazil, Uruguay, and Peru: 1 from each of Venezuela, Costa Rica, Bolivia, and Argentina. The training program is a valuable adjunct of the mission program, for it provides an increasing group of technically competent persons.

Rehabilitation of Philippine Fisheries

The fishery rehabilitation and development program undertaken by the Fish and Wildlife Service is the only project under the Philippine Rehabilitation Program concerned with food supply and production. The program is concerned with fundamental investigations and experiments in oceanography, fishery biology, ecology, exploratory fishing to determine the commercial practicability of conducting operations in various areas, the optimum types of gear suitable for exploitation of the resources in such areas, and modifications or improvements in existing fishing practices in order to provide for better utilization of the resources. Simultaneously with the foregoing, there will be conducted studies of handling, dressing, and storing catches on shipboard and at shore fishery establishments; experiments in the freezing, smoking, salting, canning, and other processing of fishery products; studies and pilot-plant experiments in the preparation of fishery byproducts such as industrial and vitamin oils, and shark hides for leather; and studies of the management of brackish and fresh-water fish ponds, with a view toward promoting greater production and efficiency.

The facilities for the program consist of well-equipped office and research laboratory facilities that have been installed in a large two-story quonset hut in the compound of the American Embassy in Manila and of an experimental cannery at another location in Manila. The fishery exploration and research at sea is accomplished by two vessels: one a combination oceanographic vessel and tuna clipper, the other an experimental purse seiner and trawler.

The in-shore fisheries, now exploited to the maximum, will never meet local requirements fully, and it is essential to the future economy of the Philippines that new exportable commodities be produced. It is expected that the deep-sea fisheries will provide both the additional locally needed food and an exportable product. Records of Japanese fishery operations on the high seas adjacent to the Philippines indicate that they caught quantities of tuna, bonito, and other pelagic fishes suitable for canning and the manufacture of byproducts.

The pondfish industry of the Philippines—where salt-water species are impounded and reared to marketable size in but a fraction of the time required in the open sea—offers great possibilities for expansion and greater production through modernization. With the cooperation of the Philippine Bureau of Fisheries, an extensive experimental program is under way involving the use of modern excavation machinery, up-to-date hatchery and pond-fertilization techniques, and training of skilled operators.

Proposed International Treaties

The many international problems and controversies, major and minor, that have arisen in connection with United States and Mexican fishing enterprises in the Gulf of Mexico and off the west coast of Mexico have led to the conclusion that an international fishery treaty is desirable. During the past 3 years the Fish and Wildlife Service has been collaborating with the Department of State in drafting proposals for a treaty, in preparing background material, and in holding consultations with representatives of State conservation departments and of the fishing industry. The valuable tuna fisheries off the west coast of the United States and Mexico and the extremely important shrimp and red snapper fisheries in the Gulf of Mexico would be effectively conserved, and when necessary regulated under the proposed international arrangement.

Popular interest has grown considerably in a treaty that will provide for international regulation and management of the fishery resources of the northwestern Atlantic Ocean. Signs of diminution in the New England fisheries and the increasing magnitude of operations on the Nova Scotian Banks and the Grand Banks of Newfoundland of vessels of European nations have given rise to popular interest in such a convention by the United States and Canada. Many informal conversations of Federal and State officials with regard to such a treaty have been held during recent years, and work toward a treaty has been intensified during the past year. The United States, Canada, Newfoundland, and France have major interest in such a treaty, since they have territorial interests in the northwestern Atlantic, but certain European nations have historical fishing rights in the area and should participate in the proposed international agreement.

Polar Expeditions

Upon the invitation of the Secretary of the Navy, the Fish and Wildlife Service assigned two biologists to the Antarctic Expedition which left the United States in November 1946 and returned in April 1947. The interests of the Fish and Wildlife Service in the expedition concerned the Antarctic fauna, primarily marine mammals and birds. A report on the more significant findings was submitted to the Navy in 1948.

During the summers of 1946, 1947, and 1948, upon invitation of the Secretary of the Navy, the Fish and Wildlife Service assigned observers to accompany Arctic expeditions of the Navy. They have secured valuable data on the fauna of Arctic waters and islands.

Whaling

The Secretary of the Interior, through the Fish and Wildlife Service, is responsible for the licensing of United States whaling enterprises, and for the conduct of biological and statistical investigations required under the terms of international agreements for the regulation of whaling. Only one whaling station was licensed in 1948. A biologist was in residence during the season to obtain biological data on the whales captured and processed, and to make observations on the abundance and movements of the whale populations.

The Fish and Wildlife Service has continued the analysis of data and preparation of reports on Japanese whaling operations since 1939, as required by international agreement, since the Japanese Government failed to meet that obligation.

An International Whaling Conference convened in Washington in 1946, and drew up two international agreements: (1) A Protocol for the Regulation of Whaling, effective only for the 1947–48 whaling season, and (2) an International Convention for the Regulation of Whaling, which replaces former basic international whaling agreements, as amended, and becomes effective upon ratification, for the 1948–49 and subsequent seasons. The convention provides for establishment of an International Whaling Commission, which is empowered to make changes in the regulations from time to time.

The Status of Waterfowl

The January 1948 annual inventory of waterfowl wintering in Canada, Alaska, coastal Latin America, and the United States showed little change from the total populations observed in 1947. The inventories of 1945, 1946, and 1947 had shown progressive declines from previous levels, and it was therefore considered encouraging that the 1948 inventory at least revealed no further drop in numbers. Regionally, however, the picture was uneven. Decreases were reported in the Central flyway, Mexico, and most of Canada except the Maritime Provinces; these were approximately balanced by increases in the Atlantic and Mississippi flyways and the Pacific Coast States of the Pacific flyway.

The spring survey of the Canadian breeding grounds of the waterfowl obtained information on waterfowl populations, surface water conditions, breeding pairs, broods produced, mortality, and climatic conditions affecting waterfowl. The field crews used airplanes, automobiles, and boats in making the survey. Preliminary reports of this survey, which was still under way at the end of the fiscal year, indicated some improvement in waterfowl production but showed that the breeding grounds were still seriously underpopulated compared with the favorable years of the past.

Waterfowl investigations have increased in scope during the year, but hardly in proportion to the need for conservation of this valuable resource. Supplementing reports of Fish and Wildlife Service observers in various sections of the United States, many State game departments are contributing information of value in drafting hunting regulations. Some States, notably the Dakotas, Minnesota, Wisconsin, and Nebraska, have joined the Service in making ground and aerial surveys of breeding areas within their boundaries. Such surveys were correlated as closely as was practicable during the 1947–48 season with similar investigations in Canada. The Dominion Wildlife Service, the Provincial Game Branches of Alberta, British Columbia, Manitoba, and Saskatchewan, and the Fish and Wildlife Service pooled manpower and efforts in securing information for effective management of the North American waterfowl population.

Research in Wildlife Management

Because of the mounting interest in more efficient and widespread control of insect pests, the Fish and Wildlife Service is continuing studies of the effects of DDT on wildlife begun in 1945. Various agencies are participating in the work, among them the Bureau of Entomology and Plant Quarantine, the United States Public Health Service, the National Audubon Society, the United States Army, the United States Forest Service, and other governmental and private groups. At Moscow, Idaho, a control project involving use of DDT over 400,000 acres of forest land was followed for its effects on fish and wildlife. At two other localities in Wyoming, the Teton National Forest and Black Hills National Forest, attempts at experimental control of forest pests with DDT and benzene hexachloride were also investigated. The effects on birds of DDT used for orchard insect control were studied at Albany, Ga., and in Allegany County, Md. At Camp Bullis, Tex., experimental studies on tick control with DDT were made, and the effects on wildlife were determined by cooperative effort with the Bureau of Entomology and Plant Quarantine and the United States Army. Aerial applications of DDT were made specifically to observe the effects on wildlife.

Studies also have been initiated on new insecticides. These have been of considerable value in further indicating the limits under which control projects may operate without seriously endangering fish and wildlife. Accumulating evidence shows that the dosage rate is the principal condition to be observed but it is also clear that other conditions of treatment can modify effects considerably. According to our present knowledge of the problem, it is unsafe to apply by airplane more than 2 pounds of DDT per acre if harm to birds, mammals, and amphibians is to be avoided. In aquatic situations the maximum amount to be applied aerially without directly endangering fish, crabs, and other forms is one-fifth pound per acre.

Investigations of wildlife in relation to agriculture and soil conservation practices continued in Maryland and in the southeast. Two experimental farms are being developed on the Patuxent Research Refuge, one area with a complete modern soil conservation and agricultural program, and the other managed by out-dated but commonly used farming practices. Living fences of multiflora rose, contour hedges, and legume field borders are examples of developments recently installed and which will be evaluated, as they grow, in terms of their effects on quail, rabbits, songbirds, rodents, and other species.

The facilities of the Patuxent Research Laboratory have been used during the year by many Federal and State governmental agencies for a variety of investigations. The Federal agencies conducting research at Patuxent and the general problems investigated were as follows: The Bureau of Standards, for experimental work in radio transmission; the Department of the Army, for research in aerial mapping; the Army Medical Center, for study of the parasites and diseases of native rodents and of the incidence of malaria in birds; the Smithsonian Institution, for study of the distribution and abundance of mosses, fungi, and lichens in relation to major vegetation types. In addition, approximately 50 investigators from various States have used the files and reference collections of the laboratory for periods of time varying from a few hours to several months. The experimental farms at Patuxent are being used by the Wildlife Management Institute in connection with its extension program, and by the University of Maryland in a study of modern land-use practices.

Research on the problems fundamental to effective rodent control has been carried forward with two objectives: First, to find more effective or safer toxic agents, and second, to develop repellents which will prevent damage to packaged goods in areas where the use of poisons would be hazardous. One possible rodenticide has received extensive study during the past year, namely, tetraethyl pyrophosphate (TEPP). This compound, and some of its homologs, offer considerable promise both as contact and oral poisons. It is, however, extremely toxic to other species, including man, and until a more complete picture of the hazards involved in its use is available, all work upon this material is being restricted to carefully controlled laboratory studies.

Several hundred materials have been tested for repellency to rodents. The more repellent chemical materials contain nitrogen or sulfur, and certain amines, such as metaphenylene diamine and dodecyl amine, are highly repellent under the test conditions. The utility of these materials under field conditions remains to be determined.

Research projects at the active Cooperative Wildlife Research Units totaled approximately 100 and involved work on waterfowl, small and big game, wildlife environment, and many other phases of wildlife management. Over 100 technical papers, bulletins, and popular articles on research findings of the units were published during the year, including The Pronghorn Antelope and Its Management, a monograph produced by the Oregon unit and published by the Wildlife Management Institute.

During the past year an average of eight field men handled the assignments for wildlife investigations on public lands, or one man to 25,140,000 acres of land, an obviously inadequate force for the tremendous obligation which exists.

Work on national forests has centered around the influences of small mammals, free-ranging hogs, and birds on reforestation; carrying capacity of longleaf-pine woodlands for deer; the effect of deer browsing on forest composition in the western yellow pine-Douglas fir forest; prevention of deer population build-ups beyond carrying capacity; and the influence of the armadillo as a forest animal.

Projects in national parks included surveys of big-game range (Glacier Zion, Acadia, and Isle Royale) and a beaver survey (Isle Royale).

Investigations of the distribution and migration of American birds progressed along several lines. Exploratory expeditions were conducted in the Canadian Arctic, Manitoba, and Idaho, and 1,325 birds specimens were added to the Service's collection.

Reports from cooperators added much detailed information to the files on the seasonal occurrence of birds in different parts of the country. Intensive population studies revealed the numbers of birds present under different environmental conditions, including specialized conditions of land utilization. An extensive cooperator program of banding birds to determine certain facts that could not be discovered otherwise, resulted in the banding of 235,000 birds, from which 14,355 bands were recovered and reported to this Service.

River Basin Development and Wildlife Needs

As the dam and reservoir programs of the Corps of Engineers and the Bureau of Reclamation developed during 1948 and projects moved from the planning to the construction stage, the Office of River Basin Studies examined the areas falling within the influence of those projects in cooperation with the construction agencies and the appropriate State conservation organizations. During the year there were completed 116 investigations of projects sponsored by the Engineers, Reclamation and, in a few cases, by the Soil Conservation Service.

The scope of present projected water-control plans for the Missouri River Basin by Federal agencies has emphasized the need for continuing the basin-wide survey of fish and wildlife resources that was initiated January 1, 1947. This survey promises to provide most useful data for evaluating the basin-wide effects, good or bad, these engineering projects will have on fish and game populations and habitat in that basin. It will assist immeasurably in helping the Office of River Basin Studies to coordinate the activities required of it and will open the way for it to recommend measures for mitigating losses or enhancing fish and wildlife benefits. During the year 1948 the Service reported on 33 Missouri River Basin projects, 29 sponsored by the Bureau of Reclamation, and 4 by the Corps of Engineers.

Power projects in the United States and Alaska, investigated under the provisions of section 18 of the Federal Power Act, numbered during the year 58. Under this act, the Secretary of the Interior makes recommendations for fish protective devices at dams constructed by public or private agencies under licenses granted by the Federal Power Commission.

A year-long study of the Grasslands, in the San Joaquin Valley, in cooperation with the California State Division of Fish and Game, was initiated during 1948. Work concentrated on a waterfowl wintering area of 100,000 acres and covered census work by plane, economic examinations of hunter costs, ground and air nesting surveys and the assembling of hunting data on more than 130 duck clubs.

As a result of recommendations made in various river basin reports the Corps of Engineers and the Bureau of Reclamation have extended approval for the development of certain proposed Federal wildlife refuge areas related to planned projects, among them being Clark Hill, Enid Reservoir, and Greys Lake. Under the development program for the Kennewick, Wash., project approved by the Eightieth Congress, appropriations have been set aside for certain upland game and water-fowl developments. A considerable number of similar small areas have been given approval for development by the sponsor.

From investigation made of water-impoundment developments on the Columbia River and its tributaries, there has been evolved the Lower Columbia River Plan scheduled to be initiated in 1949, and described above under the section on salmon conservation.

Land for Wildlife

Protection and management of migratory bids on national wildlife refuges within the United States proved again, in the past fiscal year, one of the principal safeguards for continental waterfowl populations.

Unprecedented high water in the streams of the Dakotas and Minnesota and in the Pacific Northwest proved a mixed blessing, both aiding and destroying refuge impoundments. It assured adequate water supply for the waterfowl nesting season, but did extensive damage to dams, dikes, roadways, and other facilities, as well as to many acres of food and cover plantings for waterfowl. In North Dakota, the Souris River and its tributaries, on which are located three of the major refuges, had floodwaters unequaled since 1904. A reservoir, with a storage capacity of 112,000 acre-feet, furnishes water to maintain levels in the shallow impoundments below it on both the Upper Souris and Lower Souris refuges. The city of Minot, N. Dak., is located on the river between the two projects. Skillful regulation of discharged waters during the spring of 1948 by Service engineers prevented a disastrous flood at Minot. The necessary impoundment of floodwaters to the limit of the dam resulted in extensive damage to refuge improvements on the Upper Souris refuge, but saved property and avoided damage that would have amounted to hundreds of thousands of dollars in the city of Minot.

Other refuges in North Dakota and in Minnesota were heavily damaged by floods. Excessive run-off in Oregon, including the Columbia Basin floods, did damage to refuge areas, particularly to the Malheur refuge in southeastern Oregon. Repairs on this and other projects in the Columbia Basin will cost an estimated $209,830.

An important event of the year was the establishment of the Crab Orchard National Wildlife Refuge. This area, consisting of approximately 44,000 acres and located in Jackson, Union, and Williamson Counties in southern Illinois, will be an important link in the chain of Mississippi flyway refuges, particularly valuable in its protection of Canada geese. It is expected to feed and protect some of the geese previously concentrated on the Horseshoe Lake area a few miles south. Because of the inadequate size of the Horseshoe Lake refuge, hunting on adjacent private lands had seriously affected the goose populations.

The Crab Orchard refuge offers an unusual opportunity to demonstrate the feasibility of managing wildlife on a project heavily used for recreation and industry. This project was transferred to the Department by Public Law 361, Eightieth Congress, and includes two units; some 22,000 acres of the former Illinois Ordnance Plant which was administered by the War Assets Administration, and approximately 22,000 acres of the Crab Orchard Land Utilization project, formerly administered by the Soil Conservation Service. On the ordnance plant area, the War Department made an investment of approximately 44 million dollars in buildings and facilities, including roads, railroads, water-distribution and sewage-disposal systems, and heating plants. These buildings are ideal for small factories and the leasing of buildings for industrial use was under way at the time of transfer. Public Law 361 commits the Department to continue the encouragement of such use on the area. Approximately 20,000 acres of land within the Ordnance plant area remain available for wildlife management. Because of the distribution of the industrial sites, there will be little interference with the wildlife program.

On the former Soil Conservation Service area there is one completed dam and two partially completed dams. The 7,000 acres of water impounded by the Crab Orchard Dam provides a heavily used recreational area and also supplies water for the Crab Orchard industrial development.

Management of the Canada goose, not only in the Mississippi flyway, but throughout the country, is a complicated problem. This bird is normally one of the wariest of all game birds but has been subjected to heavy hunting pressure in recent years because of its habit of accepting sanctuary on small and inadequate refuge areas.

In the national wildlife refuge system the Bear River refuge in northern Utah is the greatest goose producer. On the Malheur refuge in southeastern Oregon these birds are the most abundant nesting waterfowl. Decoy flocks of geese have been used on other refuges to encourage breeding birds to remain, with the result that Canada geese have recently nested on at least 35 of the areas.

Wintering concentrations of these geese are to be found on the Tule Lake refuge in northern California, on the Bear River refuge, the Horseshoe Lake State refuge in southern Illinois, and the Mattamuskeet refuge, North Carolina. A group of larger refuges is being developed around Horseshoe Lake, including Crab Orchard, Mingo, Reelfoot Lake, and Tennessee National Wildlife refuges. These are already proving popular for feeding and as protected resting areas.

Management of refuge areas in furthering the wildlife program makes available to local individuals and agencies resources and surplus products of economic benefit. Foremost among these privileges is the production of cultivated crops to supplement natural wildlife food supplies and to reduce waterfowl damage to crops on private lands. Controlled grazing and hay-harvesting activities are permitted in order to reduce the fire hazard on refuges and to control vegetative succession as a wildlife management measure. Substantial gains have also been made in forest-cover control, taking advantage of favorable market conditions to dispose of species of timber that are of little value for wildlife purposes.

TABLE 2.—*Number of animals on fenced big-game areas maintained by the Fish and Wildlife Service*

ANIMALS AS OF JUNE 30, 1948

Refuge	Buffalo	Elk	Deer		Texas longhorn	Total
			White-tailed	Mule		
National Bison Range, Mont.[1]	627	113	83	481		1,304
Fort Niobrara National Wildlife Refuge, Nebr.	212	63			108	383
Sullys Hill National Game Preserve, N. Dak.	18	21	29			68
Wichita Mountains Wildlife Refuge, Okla.[2]	609	241	739		292	1,881
Total	1,446	438	851	481	400	3,636

YOUNG BORN IN CALENDAR YEAR 1947

Refuge	Buffalo	Elk	White-tailed	Mule	Texas longhorn	Total
National Bison Range, Mont.	167	[3] 20	[3] 15	[3] 100		302
Fort Niobrara National Wildlife Refuge, Nebr.	48	[3] 10			24	82
Sullys Hill National Game Preserve, N. Dak.	7	4	10			21
Wichita Mountains Wildlife Refuge, Okla.	139	90	101		63	393
Total	361	124	126	100	87	798

[1] No record of young produced by 12 mountain sheep.
[2] The 40 antelope on the Wichita refuge had 10 young.
[3] Estimated.

The 1947 program, with a greater acreage cultivated by refuge personnel, resulted in 273,833 bushels of grain as well as green forage crops being available to wildlife on approximately 15,130 acres of refuge lands. In addition, cooperative farmers raised for themselves 514,335 bushels of grain and miscellaneous crops on 22,825 acres, or a total of 788,168 bushels raised on 37,955 acres of refuge lands. Livestock grazing of 297,224 animal-use months was permitted on approximately 640,430 acres, while an additional 14,800 tons of forage were cut and removed as hay from 26,470 acres of meadowlands.

TABLE 3.—*Acreage acquired or in process of acquisition for national wild-life refuges under the Migratory Bird Conservation Act and by exchange and act of Congress, fiscal year 1948*

State	Refuge	Acquired other than by purchase	Purchased under Migratory Bird Conservation Act	Total acquired	Pending title conveyance
California	Sutter				1
Florida	Chassahowitzka		158	158	2,236
	St. Marks				56
Georgia	Okefenokee		466	466	1,885
Illinois	Crab Orchard	[1] 44,000		44,000	
Iowa	Union Slough		40	40	127
Kentucky	Kentucky Woodlands		1,309	1,309	470
Maine	Moosehorn		64	64	30
Minnesota	Rice Lake				80
	Tamarac				1,568
Missouri	Mingo		4,389	4,389	4,261
	Swan Lake		3	3	
Nebraska	Valentine				304
New Jersey	Brigantine		4,216	4,216	3,050
New Mexico	Bosque del Apache				963
North Carolina	Mattamuskeet				16
North Dakota	Des Lacs				6
	Lake Ilo				40
	Long Lake				52
Oregon	Cold Springs				131
	Malheur	532		532	12,889
Texas	Laguna Atascosa				18,140
Vermont	Missisquoi		106	106	114
Virginia	Chincoteague				146
Washington	Little Pend Oreille	600		600	
	Turnbull		1,228	1,228	1,056
	Willapa				3,079
Wisconsin	Horicon		1,414	1,414	1,397
	Necedah	11		11	121
Total		45,143	13,393	58,536	52,218

[1] Former Illinois ordnance plant transferred to the Fish and Wildlife Service by act of Congress.

The emphasis in timber-removal operations was on greater stabilization through longer-term contracts. During the year 1947 timber removals amounted to 4,244,720 board feet of sawlogs, 16,160 cords of pulpwood and fuelwood, and 4,480 ties and posts.

More than 2,200 individuals participated, under special-use permit, in the economic-use program on national wildlife refuges, exclusive of the number purchasing surplus big-game animals and those who trapped fur animals on refuges. A total net revenue of $386,000 for this fiscal year resulted from all economic uses, including the disposition of big-game animals, fur-animal pelts, and surplus products. By law, 25 percent of this revenue was paid to the counties in which the national wildlife refuges are situated, and the balance was deposited in the Treasury of the United States.

In the course of the regular effort to prevent increase of the herds on the 4 fenced big-game refuges to a point where they will overgraze the range, 239 buffaloes and 123 elk, 125 mule deer, 11 white-tailed deer, and 68 long-horn cattle were removed. Whenever possible, these are donated to city and State parks and zoos for exhibition purposes, while the remainder are sold or given to various Federal, State, and private agencies or to individuals for propagation or butchering.

The number of national wildlife refuges at the end of the fiscal year 1948 was 282, totaling 18,107,024 acres. The 44,000-acre Crab Orchard Refuge in Illinois was established August 6, 1947, by Public Law No. 361. Areas dropped because conditions on them were no longer satisfactory included Carlsbad Refuge, N. Mex., relinquished on August 11, 1947; Apache Refuge, Ariz., on January 29, 1947; Rio Grande Refuge, N. Mex., on July 1, 1947; the Istokpoga Refuge, Fla., on June 30, 1948; the Palma Sola Refuge, Fla., on April 9, 1948, and the Tern Islands Refuge, La. The Yazoo Refuge, Miss., Safford Refuge, N. Mex., and Talcot Lake Refuge, Minn., were leased to the respective States as wildlife management areas. The Twin Lakes Refuge was assigned to the State of South Dakota on June 30, 1948. The Theodore Roosevelt National Memorial Park was created by Public Laws 32, 620, and 621, Eightieth Congress, on lands formerly comprising the Theodore Roosevelt Refuge, N. Dak.

Federal Aid to State Projects for the Restoration of Wildlife

Since the Pittman-Robertson Act became effective in 1938, 2,490 wildlife restoration projects have been conducted under its provisions. Although these projects are subject to review and approval by the Fish and Wildlife Service, selection of work and its performance are the responsibility of the State game departments. Costs are borne, 75 percent by Federal, and 25 percent by State funds. The Federal share of work costs is derived from the 11-percent excise tax on the sale of sporting arms and ammunition.

Congressional appropriations have varied from year to year. The smallest was $900,000, for the fiscal year 1945; the largest was $9,031,273.51, for the year 1948. During this 10-year period, $48,175,429.49 was collected from this excise tax and the Congress appropriated a total of $34,707,960.88 to finance the Federal share of the costs of program work. (The total includes the $11,276,687.37 collected during the year ended June 30, 1948, and appropriated for use during the following year.) The remaining $13,467,468.61, accumulated mainly during the recent war when appropriations were less than annual collections, represents a substantial cushion to offset the effects of any future declines in annual tax collections.

Receipts from the excise tax on sporting arms and ammunition have shown a spectacular increase since the war. The principal reasons are: First, the record sales of hunting licenses (over 12,000,000 were sold during the year ended June 30, 1947, almost double the number sold 10 years previously) with the consequent increased use of arms and ammunition; and second, advances in costs of these sporting products which in turn have swelled the volume of tax collections.

Over a 10-year period, 27 percent of the obligated funds have been devoted to acquisition of lands valuable as wildlife habitat. Land purchased for the fiscal years 1939 through 1948, inclusive, have totaled 873,667.71 acres in 36 States. Of this, 115,215 acres (13 percent) have been acquired primarily for the benefit of waterfowl. Some lands in this category have also proven to be important fur-animal producing areas, particularly for muskrats.

A second type of land purchase has been directed toward improved management of big-game animals, such as white-tailed and mule deer, elk, and antelope. Refuges or flexible closures on which hunting is prohibited or temporarily curtailed have permitted satisfactory reestablishment of remnant or transplanted herds, have made possible better range utilization where large huntable herds already occur, and have helped prevent overbrowsing of available food and consequent starvation during severe winter weather. The acquisition of 551,352 acres of big-game winter range has also reduced conflicts with domestic livestock interests.

A third type of purchase has been for the establishment of wildlife areas for farm or upland game species, often accomplished in cooperation with sportsmen's groups, landowners or soil conservation districts. A total of 207,101 acres (24 percent) has been purchased for benefit of farm or upland game such as quail, pheasants, rabbits, squirrels, grouse, and fur bearers.

Developmental work, when based upon practical research findings, is one of the best and quickest ways of creating a good habitat for wildlife. During the past 10 years, 35 percent of all Pittman-Robertson apportionments to the States has been expended on developmental activities. This has been carried out in several ways—marsh improvement for waterfowl and muskrats, food and cover restoration on upland areas, trapping and transplanting stock from overcrowded ranges to understocked areas, and installation of various structures such as roads, fences, dams, dikes, ditches, and buildings, all of which play an important part in restoration activities.

Waterfowl management is largely dependent on impoundment and manipulation of water. Required control has been obtained from construction of dams, ditches, dikes, weirs, floodgates, and culverts. Such structures have been created on 27 projects in 16 States. These improvements not only make conditions better for waterfowl, but contribute greatly to erosion and flood control and water-table stabilization. They also create high-quality recreational areas.

Food and cover restoration on upland areas has been largely accomplished in conjunction with farming or pasturing activities, because smaller game species are commonly on or near such lands. A total of 26 projects in 24 States have been carried out in connection with farm game habitat restoration. Fourteen of these have been in cooperation with soil conservation districts. These developments not only have been of great benefit to game, but the work has also been good land management. Use of such plants as the lespedezas has prevented soil erosion and at the same time built up soil fertility. The soil saving and building values of these developments alone justify the cost, and all wildlife returns may be considered supplemental values.

Trapping and transplanting game species is another activity that has produced outstanding results. Moving animals from areas where they are abundant to suitable vacant ranges expands occupied territories and spreads future hunting opportunities. Most species needed for restocking must be obtained in the wild, as only ring-necked pheasants, Hungarian and Chukar partridges, and bob-white quail have been successfully raised at game farms in sufficient quantities for restocking. Experience has shown, however, that wild birds of these species are much better for transplanting than game farm stock.

The importance of restoration by transplanting is shown by the fact that during the period covered by the fiscal years 1939 through 1948, a total of 17,190 deer, 1,054 elk, 6,958 antelope, 8 moose, 193 bighorn sheep, 26 buffaloes, 54 mountain goats, 10 bears, 8,737 beavers, 743 muskrats, 1,205 raccoons, 12 martens, 13 minks, 6 peccaries, 659 squirrels, 100,605 ring-necked pheasants, 67,639 bobwhite quail, 160 mountain quail, 4,202 scaled quail, 3,790 Gambel's quail, 839 valley quail, 23 chachalacas, 119 Venezuelean quail, 4,911 turkeys, 14 sharp-tailed grouse, 187 pinnated grouse, 1,733 sage grouse, 926 chukar and 966 Hungarian partridges have been live-trapped and released. This makes a grand total of 222,982 mammals and birds transferred to new territory, where prior field investigations disclosed habitat conditions favoring survival and increase to shootable numbers.

Forty-six States, and Alaska, Hawaii, and Puerto Rico have conducted game management research studies under the Pittman-Robertson program. The great majority had not conducted any original scientific studies previously. The principal reason for this lack of emphasis on wildlife management fact-finding was inability of the States to finance such work. Availability of this grant-in-aid made it possible for the States to gather vital information leading to increase and better management of their game birds and mammals.

From July 1, 1938, to June 30, 1948, nearly one-third (32 percent) of the Pittman-Robertson funds allotted to the States have been invested in surveys and investigations. One of the most pressing needs of game departments was a general inventory of the wildlife species within each State. Many States inaugurated such projects to learn the game species present, their relative abundance and distribution. They soon learned that distribution and abundance were governed primarily by the presence or absence of suitable living conditions. Results of these studies have created a solid foundation for action programs dealing with acquisition of lands and various developmental measures.

The setting of annual seasons and bag limits has always been a difficult problem for game administrators. Spectacular increases in hunting license sales in recent years, with the inevitable heavier pressure on the resources, have made it much more difficult than before to reach sound conclusions on proper open seasons and bag limits. Since the Pittman-Robertson program has been operating, annual field studies conducted by trained and experienced wildlife technicians have been supplying the facts. State game administrators now rely on this information instead of on unfounded estimates or uninformed public opinion.

Cooperative Control of Predators and Rodents

The control of harmful animals during the past year has materially contributed to the production of increased amounts of livestock, poultry, farm and orchard produce, and other materials that are subject to destruction, contamination, or damage by predators and rodents. Widespread application of modern methods has been aided by the cooperation of States, counties, cities, and associations of stock raisers and farmers. States contributed $1,243,345; counties, cities, livestock associations and others contributed $1,865,028; $846,511 came from regular Federal appropriations; and $160,000 from the President's Food Conservation Fund; making a total of $4,114,884 expended for cooperative rodent and predator control during the past fiscal year.

The recorded catch of predatory animals consisted of 90,270 coyotes, 1,067 wolves, 7,223 bobcats and lynxes, 744 stock-killing bears, and 148 mountain lions. In rodent control operations 11,824,520 acres of land were treated for the control of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, kangaroo rats, porcupines, and woodchucks. In addition, 831,987 premises were treated in cooperative campaigns for the control of house rats. Equipment and supplies used in predator and rodent control, and 615,490 pounds of rodent bait materials were distributed to cooperators throughout the country by the Supply Depot at Pocatello, Idaho.

In addition to emergency work on rats, outlined below, the regular program of predator and field rodent control was maintained through cooperative agreements in 34 States. Widespread use of improved control methods, under Service supervision, resulted in extension of beneficial results on an even greater scale than achieved in the previous year.

Early in the fiscal year a world-wide need for grain and other foods caused the Nation to seek and adopt every possible means for preventing waste of domestic food and feed supplies. The Service, through its long experience in rat control, was, with the cooperation of the Extension Service of the Department of Agriculture, able to give immediate aid to farmers to curb the wastage by rats, estimated at 200,000,000 bushels of grain per year.

As a corollary to the rural rat control campaign, the Department of the Interior, through the Fish and Wildlife Service, conducted an urban rat control program during the last 4 months of the fiscal year. This was financed by an allotment of $160,000 from the Department of Agriculture, from the President's one-million-dollar Emergency Food Conservation Fund (Public Law 395, 80th Cong.). To facilitate participation by industry and citizens in general, the Secretary of the Interior asked Hamilton M. Warren, vice president of the National Carbon Co., New York City, to form a national committee for rat control, consisting of prominent leaders in industry and civic affairs. Through the cooperation of this committee, a large amount of publicity was contributed by cooperating agencies and industry.

During the 4 months of the program (March 1 to June 30, 1948), the entire urban population of the Nation was informed of the rat menace and rat control methods through the cooperation of a great many newspapers and cooperating industries, as well as several magazines, radio networks and radio advertisers having Nation-wide coverage; and over 4 million bulletins and leaflets on rat control were prepared and distributed in response to requests. A temporary staff of 59 persons was employed during the National rat control program, of which 36 were trained rat-control specialists temporarily released from their regular jobs with States, counties, or cities. In this program, 580 cities representing over 52 percent of all municipalities of 10,000 population or more participated.

The amount of game and livestock saved from destruction by predators during the past fiscal year is believed to be greater than in any previous year. A cross-country review of reports shows that in California livestock losses in areas covered by Service predator control crews are estimated at 50 percent less than during 1947; in Idaho numerous observers report striking increases of game birds following predator control; Oklahoma livestock and poultry raisers report a 44 percent decrease in predator losses, compared to 1947; and in New England poultrymen have been materially aided in reducing losses from foxes. This progress, evident throughout the country, is due argely to increasing adoption of three improved predator control ethods involving the use of "coyote-getters," compound 1080 (sodium luoroacetate), and airplanes.

Rabid foxes continued to be a problem in many parts of the Southast, although on a much smaller scale than in the previous year. he Service is continuing to assist in the control of foxes in all counies that extend cooperation, and in nearly all instances is able to efect marked reductions in local outbreaks. Rabies has been present lso among foxes in Ohio, New York, Pennsylvania, and West irginia.

During the past years farm crops and range forage in certain ritical areas have been given increased protection from destructive odents, although facilities have been inadequate to give the Nationvide coverage and degree of protection desirable in these times of vorld-wide necessity for conservation of resources. Intensive use of nodern control methods in certain troublesome areas and with certain pecies has, however, contributed materially to food and feed roduction.

Prairie dogs, in particular, are being brought under control through se of compound 1080 and other methods. In five of the six National orests of New Mexico, there are only a few spots remaining to be leaned up. The Carson National Forest is the only one now having xtensive areas infested with prairie dogs. In all of Texas except the xtreme southwest portion, prairie dog work is in the clean-up stage. uch work is neither fast nor cheap, however, and will probably reuire several years for completion. In Colorado, over a million acres vere practically cleared of prairie dogs by Service-supervised crews, nd in South Dakota two large counties, Fall River and Custer, were early freed of the pest last year.

An exception to the more or less general rule of a low cycle in odent populations occurred among pine mice and meadow mice. natural cycle of abundance of these species was evident in pracically all apple-growing areas in the country. In the State of Washngton more poisoned bait was used by orchardists than during any ime in the past 20 years, but on account of the late fall and lack of xperience by many growers, good mouse control was not attained. esultant damage to orchards is estimated in excess of $100,000. rchardists of the eastern and northeastern States, although experincing moderately high mouse infestations, were able to hold their osses considerably below those of any previous similar "mouse year." his is due in large measure to the continued program of demonstraion and education carried on in the region by the Service.

The Service also aided in control of many other harmful species: angaroo rats in the Southwest; ground squirrels in several western

States; porcupines in California and New England; woodchucks in northeastern States; and cotton rats in the South, particularly Florida.

A noteworthy job of mole control was done last year in Jackson County, Oreg. Through cooperation with the Extension Service and property owners, some 3,000 acres were given a newly developed treatment involving angleworms and compound 1080, resulting in from 90 percent to 100 percent control.

Administration of Federal Statutes for Protection of Wildlife

The eight principal statutes administered by the Service for the protection of wildlife are the Migratory Bird Treaty Act, Lacey Act, Migratory Bird Conservation Act, Migratory Bird Hunting Stamp Act, law protecting wildlife and property on Federal refuges, Black Bass Law, Bald Eagle Act, and the Alaska game law.

These laws and the regulations thereunder are enforced in the United States by 6 regional supervisors of law enforcement and 64 United States game management agents.

All agents of the Service cooperate closely with officers of other Federal and State agencies and contribute materially to game management activities other than law enforcement. In parts of the United States game management agents devote a large percentage of their time to control of migratory birds when unusual concentrations of them seriously threaten the profitable growing of fruits, grain, and seed crops.

Appropriations have not been sufficient to permit enlargement of the field personnel (now numbering 68 individuals) engaged in the enforcement of the several game-law statutes administered by the Service. Splendid results have been achieved, however, by these agents in enforcing these laws and also in furtherance of cooperative relationships by furnishing to State game administrators information obtained incidental to their regular activities relative to State offenses. Details of these activities are given in tables 4 and 5.

The Black Bass Act was amended to include other fish defined as "game" fish by State law or regulation. The Service also administers the act of July 29, 1947, in extension of the sockeye salmon fishery of the Fraser River system with the aid of the Washington Department of Fisheries.

Public spirited sportsmen of Maryland and Delaware donated funds to purchase an aircraft for use of law enforcement personnel in patrolling hunting areas in the Atlantic Coast States. This plane proved to be one of the most effective means available for the breaking up of violations and the apprehension of offenders in open coastal water areas.

A total of 2,045 importation permits were issued during the year. These authorized the entry of 87,918 birds and 31,194 mammals. Fifty-six birds and two mammals of species absolutely prohibited entry into the United States were seized at ports of entry, both on the Atlantic and Pacific coasts and were either destroyed or returned to the foreign ports of origin.

Migratory bird permits issued during the fiscal year were as follows: To collect for scientific purposes, 287 (295 last year) ; for propagating purposes, 293 (283 last year) ; to take for propagation, 21 (20 last year) ; for banding, 54 (81 last year). A total of 49,210 migratory waterfowl were raised under Federal propagating permits, an increase over last year of 4,129. The number sold for food was 6,626; 5,470 were liberated.

At the end of the fiscal year permits outstanding were as follows: Propagating, 3,644; scientific collecting, 2,038; scientific possession, 622; special possession, 3,479.

Depredation permits to alleviate crop damages by migratory birds issued from the offices of the Regional Directors numbered 523, a decrease of 161 from the previous year.

TABLE 4.—*Summary of penalties imposed during the year for violations of wildlife conservation laws, 1947–48*

Act	Convictions	Fines and costs	Jail sentences
	Number	*Dollars*	*Days*
Migratory Bird Treaty Act	457	$26, 614. 40	559
Migratory Bird Conservation Act	25	642. 05	70
Migratory Bird Hunting Stamp Act	42	1, 681. 00	
Wildlife Refuge Trespass Act	4	560. 00	
Lacey Act	6	650. 00	
State prosecution from Lacey Act investigations	36	1, 321. 18	
State laws, cooperative prosecutions	2, 491	93, 133. 56	105
Total	3, 061	124, 602. 19	734

TABLE 5.—*Cases of violations of the Migratory Bird Treaty Act disposed of during the year, and cases still pending on June 30, 1948*

Disposition	Number	Pending	Number
Conviction	457	From preceding year	92
Dismissal	10	New cases	653
Nol pros	28		
Closed without prosecution	23	Total	745
Found not guilty, jury trial	6	Disposed of during year	535
Found not guilty, by court	11	Pending at end of year	210
Total	535		

The National Park Service

NEWTON B. DRURY, *Director*

NATIONAL parks are an American invention. In the establishment of these scenic reserves and in the preservation of places of historic, prehistoric, and scientific importance as national monuments, military and historical parks, for human "benefit and enjoyment," this Nation has originated a distinct type of land management and has acted on a scale that justifies deep pride in the hearts of the 145,000,000 men and women and children who own these lands.

The National Park System affords Americans a means of obtaining a better understanding of the natural forces and human influences that have shaped their land. Visitors have been impelled by many motives as, since the war, they have in unprecedented numbers eagerly sought the national parks. They come to see, to enjoy, to learn, to find refreshment of body and spirit. The touch with unspoiled nature gives them strength. Living again in memory the heroic episodes of our past enhances their national pride.

In endeavoring to attain the purpose of the National Park System, the National Park Service faces two great challenges:

First, the need of more adequate funds. The appropriations provided have fallen far short of the requirements created by vastly increased attendance, the establishment of new areas and new functions, the cessation of development during the war, and the obvious fact that, measured in dollars, much greater sums than were formerly adequate are needed to do today the work of protecting, administering, and developing the national parks.

Second, the increasing pressure for breaking down national park policies and standards. Economic need in some cases, and sheer promotion in others, has led to greater and greater demands for the cutting of forests, the grazing of meadows, the damming of streams and lakes, and other destructive uses of the national parks.

Both of these issues call for thoughtful analysis and concerted effort on the part of all who believe in the National Park Service and the importance of its work. In this report we consider it our duty to discuss them factually, as well as to tell what has been accomplished during the past year.

To attain the purposes of the national parks, as intended by the Congress and the American people, requires something more than setting aside the lands themselves. It takes, first, thoughtful planning for the uses to which they are to be put, then the development toward which that planning is directed. It requires all the means of helping people to appreciate their significance and, in enjoying them, to use them without abuse. There must be constant maintenance and repair so that all facilities—roads, trails, structures, utilities—may provide the services expected of them.

During the travel year that ended on September 30, 1947, more than 25,250,000 persons visited the areas administered by the National Park Service—an increase of better than 3,500,000 over the preceding year. This year's record will undoubtedly exceed that by a million or two. Yet, while some areas appear at times to be overcrowded, most of them are far from being used to capacity. Many more Americans should share in their enjoyment.

To this end there is needed a comprehensive program of development and improvement. This involves modernized road and trail systems; suitably placed and pleasant-to-use camp grounds; adequate water and waste-disposal systems; decent housing for employees and their families; modern administrative and working quarters, museums and trailside exhibits; and, whatever the means of providing them, sufficient accommodations for visitors, offered to them at prices that all groups of our people can afford.

There are needed, too, a more adequate and better executed program of services that will help the visitor to understand the purposes for which these areas have been established and to appreciate the natural phenomena or the historic objects preserved in them; better facilities and enlarged staff to acquaint the general public with their park estate, and to give adequate provision for the protection of priceless and irreplaceable properties against either unnecessary wear or the acts of the careless and the vandalistic. Most of all there is needed, in the words of Secretary Krug, "protection of resources which are now being used for their highest purpose—the inspiration and enjoyment of the American people—against any commercial exploitation that cannot be justified on the basis of need so great that the economic stability of our country, or its existence, would be endangered unless such use were permitted."

The annual report of the Director for the fiscal year 1947 gave concrete examples illustrating two outstanding facts: (1) That the National Park Service was not adequately staffed, either in field or central offices, to perform satisfactorily the functions expected of it, and (2) that the National Park System, seriously undeveloped, was not equipped to care properly for numbers of visitors vastly greater than those for which most of the existing plant was originally designed.

The past year has brought aggravation to, rather than relief from, the conditions then existent. Staffs in the field areas, to care for the safety, comfort, sanitation, and interpretive needs of visitors, remain materially smaller than before the war. Anticipated construction programs, so often mentioned in terms of bright promise during the war, have failed to materialize. Millions of Americans have visited the parks under conditions which do not permit full measure of enjoyment; very real physical harm has been done which will require years to correct or erase.

Development needed soon.—The sober conclusion must be faced that a great deal of development work must be undertaken, and soon, without waiting longer for that hoped-for time when the costs of construction may decrease. Without such a program, the National Park System cannot serve the public as it should.

Another aspect of the present situation gives us deep concern. It is only by the exercise of great ingenuity and a loyal public-spirited disregard of overtime that it has been possible for the present employees to keep things going to the reasonable satisfaction of the visiting public. No public agency, however, can operate "on a shoestring" indefinitely and expect to sustain the morale of even the most conscientious and devoted employees.

Older areas need new look.—Many of the long established areas of the system received most of their existing development 20 or more years ago when travel was in tens of thousands by comparison with the hundreds of thousands in the same areas today. Since then, some progress has been made in planning and construction. Road systems crystallized, and a good start was made on circulation systems involving roads, bridges, and tunnels. Yet some roads started as early as 1931, representing the investment of several millions of dollars, are still incomplete . Perhaps the outstanding example is the New Tioga Road in Yosemite National Park, where two stretches of modern, improved highway are separated by 21 miles of crooked, dangerous, and unimproved road. Other examples are the long incomplete road system at Acadia National Park, and the half-finished Stevens Canyon road at Mount Rainier. There are many others.

The CCC and WPA programs permitted considerable progress in developments that did not require large quantities of materials or skilled labor. General clean-up, camp-ground development, trail construction, and the building of protective truck trails made good progress; but no similar sources of labor are now available.

Only a few of the larger buildings and utility systems required for most of the parks were provided through emergency funds. Today there is a tremendous accumulated need for employee housing, fire-resistant shop and warehouse buildings, administration and museum buildings and enlarged camp grounds, as well as for additional lodges and cabins usually provided by concessioners and the utilities required to serve them. In several of the parks the point has been reached where entire headquarters or hotel and lodge operations need to be scrapped and others provided at more suitable sites. In some cases, needed expansion cannot be undertaken at present sites without encroachment on scenic features. In others, sites with more adequate water supplies are required; in still others, developments need to be removed to locations where there is less snow to render winter operation difficult and expensive. Mount Rainier, Crater Lake, and Sequoia National Parks all need relocation of headquarters. The Canyon area at Yellowstone and the Giant Forest area at Sequoia are undergoing similar transition as to hotel and lodge facilities.

Use outruns development.—The newer areas, several of which are large and offer complex problems of development, are receiving heavy use before even the most simple facilities are provided, yet by no means as much as would be the case if they were properly developed. Olympic National Park is inadequately developed, and Kings Canyon but little better. Public use is pushing far ahead of provision for it in Big Bend and Everglades National Parks, in Lake Mead, Millerton Lake, Coulee Dam, and Lake Texoma recreational areas, and in numerous smaller areas such as Theodore Roosevelt National Memorial Park, Fort Frederica National Monument, and the Home of Franklin D. Roosevelt and Adams Mansion National Historic Sites.

The case of the oldest park.—It will perhaps be enlightening to analyze the development needs of a few typical areas. Yellowstone National Park, longest established of any in the System, probably exemplifies most of the conditions which today prevent the older national parks from offering visitors the satisfying experience they seek.

In 1920, 99 percent of the 80,000 visitors to Yellowstone came by train and toured the park in open motor buses. Seven years later, 99 percent of visitors came in their own cars. The total had jumped to 200,000 for the season, and the average stay was 3 to 5 days.

In 1925, the Service started to convert the wagon-road system of the park to a motor-road system. By 1935, enough had been reconstructed for the average visitor to make the park tour in 2 or 3 days. That year, attendance reached 318,000. By 1941, when there were 582,000 visitors, most of the Grand Loop had been reconstructed, though about one-eighth of it was still to be graded and a quarter of it to be surfaced. The south, east, and northeast entrance roads had been rebuilt, but not those coming in from Gardiner or West Yellowstone. Practically no reconstruction has been accomplished since 1941 and much that had previously been built has deteriorated so seriously as to need major repairs—something far beyond mere maintenance.

In 1941 accommodations of all sorts, including the auto camps, were geared to an annual visitation of less than half a million, with an average stay of 2 to 3 days. Yet during the 1947 travel season, 932,000 visitors bounced over the bad roads; camp grounds were far from adequate to meet their requirements; many who sought accommodations were forced either to sleep in their cars or to shorten their stay by seeking quarters 60 to 80 miles outside the park. This year it seems certain the visitor total will exceed a million. Probably nothing short of another war would ever reduce attendance at this park of varied attractions to so low a figure as half a million; it is fair to assume that it will continue to remain at nearly twice that figure, and its development should be based on that assumption.

The development at Old Faithful has about reached the saturation point. New facilities are planned at Thumb to accommodate the steadily increasing number of visitors entering from the south, and to take the overflow from Old Faithful. A lodge and cabin camp is projected to accommodate 1,200 to 1,500 persons, as well as an automobile camp of 400 to 500 sites, to be supplemented by a tourist center providing the necessary stores, service stations, etc. This will mean a concessioner investment of $750,000 to $900,000, and the expenditure of about $600,000 by the Government on camp grounds, roads, parking areas, and the necessary utilities—water, sewers, and power.

At Canyon, redevelopment to replace obsolete facilities and increase capacity will require an investment by the concessioner of $1,000,000 to $1,250,000 and by the Government of $600,000 to $700,000. At Old Faithful, increased travel requires major changes in vehicle circulation, to be coordinated with the relocation of certain other facilities. There is need for Government expenditures here, within the next 2 or 3 years, of $100,000 to $150,000 in expansion and modernization of utilities and approximately half a million dollars for road relocation, additional parking areas, and secondary roads.

At Lake and Fishing Bridge, the Government program calls for extension and improvement of utilities costing $200,000 to $300,000, camp-ground extension costing $150,000 to $175,000, and $300,000 to $400,000 for construction of necessary roads and parking areas. The headquarters area at Mammoth has been utilizing for 30 years an abandoned Army post; here is needed a new facility designed for the purpose. A new administration-museum building, a modern and efficient utility area of warehouses, shops, equipment storage, etc., and considerable new construction as well as reconstruction of employees' living quarters would cost $2,000,000 to $2,500,000. Outlying developments of various kinds would require another $500,000.

The status of the highway system of the park has already been indicated. The present road system, when completed, should be adequate to handle the traffic of the next decade. The over-all figure for its completion is $11,000,000 to $13,000,000.

Over and above the investment required of the concessioner, adequate developments at Yellowstone National Park over a period of

10 years would involve the expenditure of $15,000,000 to $20,000,000 of appropriated funds.

What Great Smoky needs.—Great Smoky Mountains National Park is another example. It was added to the System during the 30's and benefited greatly from the kind of development that could be supplied by the CCC; it also acquired a fine headquarters building on the Tennessee side and a subheadquarters building near the North Carolina entrance, which were PWA projects. However, it has no central utility group. Interpretive facilities are extremely meager. Employees away from headquarters are housed in residences surviving from the days before the park was established, many of which lack even the most essential of modern conveniences, while headquarters employees are at the mercy of resort-town rents.

Both in North Carolina and Tennessee there is considerable impatience over the lack of development in this park, and the two States have organized jointly to urge an accelerated development and a staff of sufficient size to provide adequate protection and a well-rounded interpretative program.

The completion of major roads now on the master plan of the park, and 14 miles of reconstruction of the Newfound Gap Road, would cost about $14,500,000; minor roads and trails call for approximately $460,000 more. Employee residences, utility structures, picnic and camp ground developments, museums and other interpretative facilities, sewer, water, telephone and power lines, and miscellaneous physical improvements would cost approximately $2,000,000.

It has been considered desirable to give these specific facts about these two well-known parks, but the conditions are not materially different from those in such older parks as Yosemite, Mount Rainier, Grand Canyon, Rocky Mountain, Crater Lake, and others, and, as already noted, in those more recently added to the System.

Wupatki.—Similar considerations apply to most of the smaller areas, notably the national monuments. Wupatki National Monument, in eastern Arizona, rich in the ruins of pueblos and homesites of the ancestors of the Hopis, is a typical case. A monument since 1924, it was enlarged from its original 640 acres to more than 34,000 in 1937, when it was first reached by highway. In 1940 it was provided with a residence, a garage, and a water system. That is all it has ever had.

Because it was underdeveloped and understaffed, ruins have been destroyed by cattle and pot-hunters; visitors have had a difficult time reaching the ruins and have not been given interpretive or guide service; nearby residents have discouraged potential visitors from going to the area; and generally the purpose of the monument—preservation of the ruins and intelligent presentation to the public—has been defeated.

Comparatively modest sums are required to equip Wupatki and other smaller areas. An adequate water system; administration, residential, and utility buildings; light, power, and communication; and the fencing of the boundaries would cost little more than $100,000 at Wupatki. A proper circulation system of roads and trails would cost about $250,000. Wupatki's situation is not unique; on the contrary, it is duplicated in greater or less degree in most of the monuments.

What has been said about Yellowstone, Great Smoky, and Wupatki might be repeated as to most of the areas, big and small, in the National Park System.

Water rights subject to lapse.—One matter of paramount importance wherever people congregate has been given scant attention in developing the national parks. Adequate water supplies in parks and monuments throughout the West are obtained in many instances through grants of water-right permits by the various States. Proofs of construction of water systems and actual use of water must be made before final water-right licenses or certificates are granted, on schedules prescribed by the various States to show diligent prosecution of the work. Although some proofs are being made, in increasing instances extensions of time must be sought from State engineers because of failure to complete water systems or make full use of water under the more than 100 permits now in effect. Until the construction, reconstruction, or enlargement of water systems to meet the greatly enlarged water requirements of present-day attendance can be provided, many of the rights cannot be perfected for the use of more water than was used by the visitor population of 1940 and 1941.

A glance at Alaska.—The tourist industry, it is generally recognized, offers one of Alaska's greatest opportunities to improve her economy. There are three major units of the National Park System in Alaska, comprising nearly 7,000,000 acres. Of these only Mount McKinley National Park has either development or administration, though neither is adequate. Katmai and Glacier Bay National Monuments are both completely undeveloped.

Glacier Bay National Monument has superlative scenic qualities probably not surpassed by any national park. It contains 2,297,456 acres. Located only 45 miles west of Juneau, capital of the territory, it is easily accessible to existing steamer routes, and is only an 8-hour cruise from Juneau by small boat. Acquaintance with it and its spectacular natural features—its mountains, glaciers, ice fields, and wildlife—is denied to prospective visitors by its lack of docking facilities, lodgings, eating places, and other facilities.

During the war, the National Park Service permitted the War Department to build a first-class airfield near the entrance to Glacier Bay. It is now operated by the Civil Aeronautics Administration, and is a key field in the Alaska air navigation pattern. Weather conditions are so favorable that planes can take off or land there when other Alaska fields are closed in. Development of facilities at Glacier Bay would provide for monument visitors arriving either by boat or plane, and for plane passengers held there because of bad flying conditions at other fields.

An initial development is planned at Bartlett Cove, 6½ miles from the airfield, and close to the established steamer route. Accommodations here would provide the principal base for small-boat trips to the upper reaches of Glacier Bay. The proposed development, including that at Bartlett Cove and in outlying areas, is estimated to cost between $3,250,000 and $3,500,000.

Katmai National Monument is not so convenient to reach and contains less to attract the general run of tourists. It principally needs a small administrative and protective staff, now totally lacking, and the housing and other facilities such a staff would require.

With millions visiting the parks of the mainland, the National Park Service cannot logically contend that the Alaska areas should have priority over the parks that are more heavily used. Yet if the policy of the Government is to stimulate tourist travel to Alaska, we consider it important to point out the above pertinent facts.

Voices from the field.—Park and monument superintendents and custodians are a loyal, hard-working, patient group. They are not, as a rule, and by nature, prone to complain. Most of them are accustomed to having to get along with something less than seems desirable or even necessary. They do, however, attempt to report conditions and situations as they find them. It is natural therefore, that their own annual reports should reflect inadequacies of development. The quotations which follow are only a few of many which appear in these reports:

> Camp grounds continue to be overcrowded and the associated vegetative cover continues to receive abuse. Vegetation in some areas may be irreparably damaged, but in any event restoration will be slow and costly. New and enlarged camp grounds are urgently needed to provide facilities for the unprecedented number of visitors desiring camping accommodations.—Regional Director, Region Two, Omaha, Nebr.
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> Expanded parking facilities and relief of congestion in the concessioner's development area are two critical needs. As studies continue, it becomes more evident that nearly all aspects of existing physical improvements are affected.—Mesa Verde National Park, Colo.
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> Forecasts have been published in the newspapers stating that the San Joaquin Valley will be the home of 10 million people within the next several decades. A census figure even half of that predicted will exert heavy pressure for greatly expanded facilities in Sequoia and Kings Canyon National Parks. It is a situation which alone makes the immediate start of a program of expansion of facilities urgently necessary.—Sequoia-Kings Canyon National Parks, Calif.
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> The primary purpose of the Master Plan cannot be achieved until an adequate water supply is obtained from one of the several possibilities: Privately owned

springs, a 7-mile pipe line, or drilled wells. Whatever the decision may be, it will require money.—Wupatki National Monument, Ariz.

With nearly 300 miles of oil-surfaced roads, most of them constructed approximately 10 years ago, depreciation all over the monument has been progressing very rapidly. Many miles are becoming almost unsafe for travel. The condition of buildings is even more acute, as allotments have done little more than permit some reroofing and minor repairs. Employees' residences were constructed of the lightest possible materials and it has not even been possible to paint them on the outside to check destruction of the Celotex siding.

Water mains in almost all instances were constructed with CCC funds and all galvanized pipe, which deteriorates rapidly here unless asphalt dipped and covered. Scarcely a week goes by that breaks do not occur, particularly in the public camp ground. All mains should be replaced soon.—Death Valley National Monument, Calif. and Nev.

Conditions have changed little from a year ago, due to lack of funds and general shortage of needed equipment and supplies. Roads and picnic areas are inadequate to accommodate the crowds. Rest rooms are not yet completed. The water supply for the picnic areas is inadequate, and plans should be made to improve this condition.—Great Sand Dunes National Monument, Colo.

Our administrative office building is an old residence with outdoor plumbing. More than half our employees must live outside the park because we have only 14 housing units to accommodate 28 regular employees. This means half our personnel have to find houses outside the park in a small village where the only resource is to buy; no houses are rented. Many of the available units are too small. We have one family of three in a one-room house. Three families of four are living in one-bedroom houses.—Zion National Park, Utah.

Employee housing.—The critical problem of employee housing is dwelt upon by practically all of our superintendents. It is the policy of the National Park Service to provide housing for its employees in the field only where they cannot reasonably be expected to obtain it in nearby communities. Yet in a great many cases it is necessary, in the interest of employee and Service alike, to construct housing with appropriated funds. Field employees are subject to frequent transfer as the needs of the Service require or as they advance in the organization. It is seldom practical for them to own their own homes—a condition which sets them apart from the vastly greater number of Americans who are more permanently parts of their communities. It is believed that there is ample justification for Government ownership of residence structures in all but the few cases in which areas are close to large urban communities. The situation is not materially different from that of members of the Armed services, for whom the provision of housing has long been accepted as necessary and justified.

The 40-hour week and the change in marital status of the majority of those who now seek employment with the Service—mostly married veterans—amply justifies a housing construction program that, for a period of 3 or 4 years, would utilize each year an amount equal to the Service's total physical improvements appropriation for the 1949 fiscal year.

The Shortage of Personnel and Its Effects

The widespread shortage of personnel in the parks and monuments and in central offices, which has existed since the war, continued and grew worse during the year just past, nor is any relief in sight during the 1949 fiscal year. Increases in appropriations for administration, protection, and maintenance of field areas over those for last year are not nearly sufficient to meet the increases in wages to "wage board" employees (those whose rates of pay are determined by wage boards, in contrast to those whose rates of pay are fixed by the Classification Act) and the much greater costs of necessary supplies.

The Service obviously is not staffed to serve the public in a manner that permits the fullest enjoyment of the areas it administers. It cannot supply the protection critically needed for natural and historic features. Yet, as during preceding years, employees have contributed uncompensated overtime to an extent deeply appreciated by all those in authority in the Service but little understood by the visiting public.

About 21,071 hours of overtime in one park.—"In order to keep the park operating with limited funds, it was necessary for permanent employees to work many hours of overtime without pay," says the Superintendent of Glacier National Park in his annual report. "A special report was submitted on February 28, 1948, showing that 21,071 man-hours of voluntary overtime had been contributed from July 1, 1946, to January 31, 1948. Since then, the amount of voluntary overtime has increased considerably and will continue to increase."

In many parks, inadequacies of personnel have resulted in considerable losses in revenue. At Glacier, it was possible to man only two entrance stations; at Grand Canyon, in June, only a single ranger could be assigned to the east entrance, for 8 hours a day; the same was true at the north entrance. At Rocky Mountain, the superintendent estimates that revenues which would have amounted to more than $8,000 went uncollected because of inability to maintain continuous entrance station operation. The superintendent at Yellowstone sets the loss there at $75,000. At Zion, the available ranger force could operate the two checking stations only a part of the time during the winter. Similar situations in a number of other areas are complicated by the fact that, to avoid still greater losses of revenue, rangers are assigned to checking stations who are greatly needed for protective services.

Field comment.—Taking again the testimony of men who are in the best position to know, the following are typical of expressions which appear in reports from field areas throughout the National Park System:

> Automotive and other equipment has deteriorated abnormally because of lack of mechanics and an equipped repair shop. Timber trespass is given mute

encouragement because of our lack of anyone to establish our boundaries satisfactorily.

Inadequate ranger personnel does not allow sure protection to our many species of wildlife. Enforcement of regulations has been sadly neglected in certain sections due to the impossible task of covering so great an area with a force designed for an area of about one-fourth its size.

Only a sincere love for the national park concept and a truly loyal feeling for the Service has impelled our men and women to carry on in the face of what seemed insurmountable obstacles.—Olympic National Park, Wash.

All branches of the park's administration, protection, and maintenance groups are understaffed. The duties expected of them are more than can possibly be performed. Thus it is necessary for all branches as well as the administrative office to lag in their duties and try to pick up the tasks that are most important and let others fall behind.—Big Bend National Park, Tex.

The postwar travel exceeds prewar travel by 400 percent and has been handled without an increase in the ranger service. The impact of increased visitation has resulted in an increasing amount of vandalism, which, if continued, will seriously and permanently impair the cave formations. Interpretation is well below the desired standard due to the number of visitors each ranger must handle.—Wind Cave National Park, S. Dak.

The shortage of funds results in inadequate personnel for administration of the areas. For example, Fort Pulaski National Monument must be closed 2 days of the week; at Fort Frederica little service can be given to the numerous visitors because of the work to be done in clean-up and maintenance by the custodian and one maintenance man; the sizeable operation at Fort Jefferson demands the full time of three men at the fort and compels us to operate the 65-foot boat across 60 miles of open water with one man. The staff at the Castillo is so small that frequently the large classes of school children from Florida and Georgia, convention groups, and organizations must wander through this unusual historical structure without supervision or information service.

Our personnel are enthusiastic and devoted to jobs of public service and continue to perform admirably without complaint. But it is hard for our friends and supporters to understand why complete services are not available 7 days a week, especially when our areas are the principal objectives of the traveler.

The answer to our problem in the Southeast is not the building up of a big organization. The addition of one or two men at most areas, or three at the critical areas, would permit us to give the protection and the service the traveling public deserves and pays for. Private attractions, in the lower South, know that adequate service is good business. The same degree of service would be good business for the National Park Service.—Southeastern National Monuments, Fla. and Ga.

A feature of the monument travel which is hard to control is the heavy night use. Local people who want to escape the heat of the valley spend the evenings on the drive. Also hoodlums looking for a place to hold an all-night party. With personnel insufficient for even an 8-hour shift it is a problem to supply much protection or control, not to mention service or any interpretive program. It is only by donating long hours of overtime that even the pressing maintenance, sanitary, and control problems are cared for.—Colorado National Monument, Colo.

Operating with two rangers less than in prewar days resulted in a minimum of patrolling. Valuable deposits of petrified wood adjacent to Highway 260 and near the boundaries in accessible places were left unprotected, except for possibly one or two patrols each week.—Petrified Forest National Monument, Ariz.

Vandalism.—Reports from the field also comment, as they have for the past several years, on the extent of vandalism, which seems to vary inversely with the adequacy of protective forces. This is equally true with respect to the carelessness that results in littered roadsides, campgrounds, etc., where the tendency to dispose of trash in the wrong places can be largely restrained by preventing accumulations of it. The effects of over-use, due to inadequacies of camp grounds particularly, are in the long run not much different from the effects of vandalism but can be cured only by developments which more nearly meet the requirements of the public.

One of the most disheartening examples of vandalism of the past year resulted in the destruction by fire of most of the Washingtonia palms in the 49 Palms Oasis, Joshua Tree National Monument. Two teen-age boys picked up near the scene of the fire admitted responsibility and were turned over to the San Bernardino County Juvenile Court.

An encouraging note, in the form of more effective control of wear and tear and of incidental vandalism, comes from Yellowstone National Park. The project started there in 1946 of protecting the thermal areas by the use of prefabricated wooden walks was continued during the summer of 1947. An additional 2,000 feet was fabricated during the past winter and was laid as soon as weather conditions permitted.

"It has been estimated," the superintendent of the park reports, "that the wear on the formations, in the areas where these walks have been installed, has been reduced some 90 percent." Unfortunately, no protection but an adequate ranger force, not yet provided, has been found against the widespread habit of visitors throwing rocks, trash, and debris into the loveliest and most delicately colored of the pools.

Personnel management.—Though shortages of personnel handicap the central offices, and, in particular, the personnel office of the Director's Office, a significant and satisfactory development in the field of personnel management was the Civil Service Commission's acceptance of National Park Service recommendations that all park ranger positions be placed in appropriate grades of the clerical, administrative, and fiscal (CAF) service. The conversion of these positions to CAF grades will be a major task of the personnel office this year. Headway was also made in converting a good share of war-service and temporary-indefinite employees to competitive status, and in terminating a large proportion of the remaining leaves of absence for military service and war work. There is evidence that much has been accomplished in the field in on-the-job training of seasonal and permanent employees, without the use of any additional funds for the purpose, and without the benefit of guidance from any training specialist.

On the debit side, the personnel office has been severely hampered by the limitation imposed on the use of funds for personnel administration in the Interior Department. The effects have been most marked in position classification, where an impossible load has been thrown on a single position classifier. The result is a continually mounting backlog of classification actions which reflects adversely on all phases of personnel administration and upon the Service's work.

Personnel actions.—Important personnel actions during the past year include the following:

Retirements: John R. White, Superintendent, Sequoia and Kings Canyon National Parks; Joseph Mills Hanson, Custodian, Manassas National Battlefield Park.

Appointments: Daniel B. Beard, Superintendent, Everglades National Park; Marshall H. Jones, Consultant, Concessions Division; James B. Robinson, Assistant Chief, Concessions Division.

Promotions: James L. Bossemeyer from Park Planner, Region Four, to Chief, United States Travel Division; John B. Doerr from Assistant Chief Naturalist to Chief Naturalist, Director's Office; Paul R. Franke from Assistant Chief, Concessions Division, to Assistant Chief Naturalist; Preston P. Patraw from finance officer, Director's Office, to Associate Regional Director, Region Three; Keith Neilson from Chief Accountant to Finance Officer; Ben H. Thompson from Assistant Superintendent, Lake Mead Recreational Area, to Special Assistant to the Director; Allyn F. Hanks from Chief Ranger, Grand Teton National Park, to Superintendent, Theodore Roosevelt National Memorial Park; Fred J. Overly from Assistant Superintendent, Olympic National Park, to Chief, Real Estate Branch, Division of Land and Recreational Planning, Director's Office.

Transfers: Dr. Carl P. Russell from Chief Naturalist, Director's Office, to Superintendent, Yosemite National Park; Frank A. Kittredge from Superintendent, Yosemite National Park, to Chief Engineer, Director's Office; Frank L. Ahern from the Office of the Secretary to his former position of Chief, Safety Office; Eivind T. Scoyen from Associate Regional Director, Region Three, to Superintendent, Sequoia and Kings Canyon National Parks.

New Construction Greatly Limited

Physical improvements.—Major repairs and rehabilitation of existing facilities took approximately half of the funds appropriated during the past year for physical improvements. Little new construction could be undertaken. An appreciable amount of comparatively small, but urgent, structural and mechanical repairs was accomplished, where facilities had deteriorated beyond the point where such repairs could be undertaken in the course of normal maintenance. But many such jobs remain to be done.

The construction of new facilities was undertaken with the balance of the physical improvements appropriation—less than $400,000. Most of these projects had to be small. Among those accomplished or under way, and not mentioned elsewhere, are award of a contract for a residence and attendant utilities at 20-Mile Warden Station in Great Smoky Mountains National Park; modernization of the electrical system at Perry's Victory and International Peace Memorial National Monument; award of a contract for a water main from Jersey City to Statue of Liberty National Monument, delayed pending receipt of material; and construction of a water-system project at Big Bend National Park. Plans have been completed and are ready for contract on a number of other such projects. In addition the Bocock Isbell House was renovated and reconstruction of the McLean House was started, with funds previously appropriated.

Roads and trails.—The few major road contracts programmed for the year are all either completed or under contract. These include 15 miles of grading and base-course surfacing, 48 miles of paving, and completion of one structure. Among individual projects are grading and base-course surfacing of the Cades Cove Road and a portion of the Bryson-Fontana Road, in Great Smoky Mountains National Park; grading and base-course surfacing of part of the Loop Highway and the South Approach Road, and paving a portion of the Loop Highway, in Yellowstone National Park; grading and base surfacing the Zion-Bryce Canyon National Parks approach road; paving a portion of the All-Year Highway in Yosemite National Park; paving a portion of the Generals Highway and the approach road in Sequoia-Kings Canyon National Parks; and completion of the underpass in Petersburg National Military Park.

At Badlands National Monument the road from Big Foot to Cedar Pass was surfaced; roads and trails were constructed in the various development areas at Lake Texoma Recreational Area and the entrance road and new parking area at the Home of Franklin D. Roosevelt National Historic Site were graded and surfaced.

On the parkways.—Parkway work completed or under contract included the grading and base-course surfacing of 50 miles of road and construction of 12 bridges on the Natchez Trace Parkway; 128 miles of paving, 25 miles of grading and base-course surfacing, 2 grade separation structures and a viaduct on the Blue Ridge Parkway; a bridge on the west-bound road connection and the grading of 1½ miles of road in the vicinity of Key Bridge on the George Washington Memorial Parkway.

The Statue of Liberty.—During the years of the National Park Service's custodianship of the Statue of Liberty National Monument, important improvements have been made there. Yet others long planned, but unstarted or uncompleted, call for the expenditure of more than $2,000,000. As a result of aroused public indignation during the past year, $500,000—more than a quarter of the total appropriated to the Service for physical improvements for 1949—has been earmarked by Congress for a start on developments needed to provide a satisfactory setting for Bartholdi's gigantic bronze figure and to effect other improvements called for in the master plan for the national monument.

Land Program Launched; New Areas Added to System

Laws authorizing the establishment of three new historical monuments, one historical park, and one national memorial were approved by the Eightieth Congress; a new national historic site was designated by the Secretary of the Interior, while establishment of another national monument awaits only the clearance of title papers. Meanwhile, thanks to an appropriation of $200,000 for land acquisition in the 1948 appropriation, a small but encouraging start has been made toward solution of the complex problem of non-Federal lands within National Park System areas. Though no action was taken on proposed legislation which would authorize a long-range program for acquiring such lands, a favorable committee report on one such bill gives grounds for hope that definite action may be taken by the next Congress.

Mindful of the inadequacy of its means of caring for all responsibilities connected with the existing National Park System, the Service for some years has taken a conservative position with regard to the proposal of new areas. It is felt that only those areas should be added that are of such outstanding importance to the Nation as a whole, and so high in quality that their preservation is a matter of national necessity. In some cases, notably the recreational demonstration areas, the Service has advocated the elimination of properties not of national caliber.

New areas authorized or proposed.—Of 29 proposals for the establishment of new areas recorded during the past year, the great majority dealt with areas of historical rather than scenic character—a probable indication of heightened public concern with historic sites and the spreading threat of permanent loss of many of them. During the year, legislation to establish eight new national historical areas was introduced into Congress, and five of these were enacted into law.

On March 11, the President signed an act authorizing the establishment of a De Soto National Memorial in Florida. On April 28, he approved the act which instructed the Department of the Army to turn over Fort Sumter in South Carolina to the Department of the Interior for administration by the National Park Service as a national monument. The transfer was effected in June. An act to establish the Fort Vancouver National Monument, in the State of Washington, was approved on June 19. Acting upon the recommendations of a special committee, the Congress passed, and the President approved on June 28, legislation which authorizes the establishment of Independence National Historical Park, in the heart of Philadelphia. This act also authorized the appropriation of $4,390,000 to carry forward the project, though no appropriation has yet been made. Another act, passed near the close of the regular session and approved on July 2, authorizes the establishment of the Pensacola National Monument, to include several historic forts, subject to a determination that the sites possess sufficient national significance to warrant monument status.

On the three proposals on which no action was taken, the Department had submitted adverse reports.

Progress on authorized projects.—An authorized project since 1935, Kennesaw Mountain National Battlefield Park, Ga., was established upon designation of its boundaries by Secretary Krug on October 25, 1947.

Title to historic Hampton, purchased with funds donated by the Avalon Foundation, was accepted on April 5, 1948. An order designating it as a national historic site was approved by the Secretary on June 22. The property will be maintained and exhibited to the public by the Society for the Preservation of Maryland Antiquities, under a cooperative agreement.

Title papers have been received covering 1,000 acres of land donated by the State of Iowa for Effigy Mounds National Monument. As soon as title has been accepted by the Government, a proclamation to establish the monument will be submitted to the President.

In furtherance of the Coronado International Memorial project, Service officials conferred in Mexico City with representatives of the Federal Government. As a result, members of the International Park Commission of Mexico are seeking to have issued a decree establishing the Coronado International Memorial in Sonora. This step is necessary, pursuant to the act of August 18, 1941 (55 Stat. 630), before the United States can act to establish its portion of the memorial.

Cumberland Gap National Historical Park, in Kentucky, Virginia, and Tennessee, may possibly be established in 1949. Acquisition programs in Kentucky and Tennessee are completed except for a few tracts that have involved rather out-of-the-ordinary difficulties, but both States are hopeful of an early solution. Virginia has completed approximately 50 percent of her purchase program, and funds are available for the acquisition of much of the remainder during this calendar year.

Saratoga National Historical Park, N. Y., was finally established under an act of Congress approved on June 22 to include the lands deeded to the Federal Government by the State of New York and those acquired by Federal purchase since the park was authorized in 1938. Funds have been insufficient to acquire all the lands specified in the 1938 act.

The first year of the Everglades.—Established on June 20, 1947, Everglades National Park was dedicated at Everglades City, Fla., on December 6, 1947. With John D. Pennekamp, Legislative Chairman of the Everglades National Park Commission, as presiding officer, the speakers included the President of the United States, Senators Claude Pepper and Spessard Holland and Governor Millard Caldwell of Florida, and Secretary Krug. Preceding the broadcast portion of the ceremonies, the Director of the National Park Service accepted from the Florida Federation of Women's Clubs the tender of the lands embraced in Royal Palm State Park, to be added to the national park.

During the year, a long start was made on establishing an administrative and protective staff for the park. It is well balanced, and all members of it have contributed many hours of overtime to the effort to make the park a "going concern." Plant and animal life is already responding to the greater degree of protection against fires, hunting, and the collecting of orchids and other rare and unique flora.

A great amount of study has been given to the area and its needs, and a preliminary plan of development has been drawn. Because of its possible effect on land values and the land purchase program, the plan has not yet been made public.

In spite of poor road conditions, well advertised in the newspapers, and lack of accommodations, about 22,000 persons visited the park during the 1947–48 winter season. As rapidly as funds are made available, development plans to provide for public use will be carried out. At the present time little provision of this sort has been made.

During this first year of administration of the park, the cooperation of the State of Florida and of county agencies, local groups and individuals has been unceasing, and extraordinarily generous and varied.

Touro Synagogue dedication.—Touro Synagogue in Newport, R. I., designated as a national historic site on March 5, 1946, was dedicated as such on August 31, 1947. Dedication speakers included the Honorable Joseph W. Martin, Speaker of the House of Representatives;

United States Senator Theodore Francis Greene, of Rhode Island; the Right Reverend Gaylord Bennett, of the Episcopal Diocese of Rhode Island; the Reverend Dr. David de Sola Pool; Gov. John O. Pastore, of Rhode Island; and Dr. Carl Van Doren, of New York City.

Acquisition of inholdings.—One of the most important and encouraging items in the 1948 appropriation was that of $200,000 for land acquisition. At the end of the fiscal year, these funds had been 90 percent obligated. Purchases consummated or in progress include approximately 13,000 acres of Southern Pacific lands in Joshua Tree National Monument, purchased at about 75 cents an acre; an important parcel of privately owned land on the south rim of Grand Canyon; the only remaining parcel of private land in Arches National Monument; and the actual site of Cornwallis' Surrender in Colonial National Historical Park. Condemnation proceedings were also entered into to acquire the lands needed to establish the George Washington Carver National Monument, Mo., as directed in the act of July 14, 1943 (57 Stat. 563).

That Congress now realizes the desirability of consolidating Federal holdings in the National Park System is shown by the fact that the 1949 appropriation again contains an item of $200,000 for land acquisition. Of greater long-range significance to the Service, however, are the provisions of House bill 6767 and Senate bill 2132, which, in addition to providing a return of revenue to the States in lieu of taxes on property removed from the tax rolls, would authorize the appropriation of $20,000,000, at a rate of $1,250,000 annually, for the purchase of inholdings. House bill 6767 was approved by the House Public Lands Committee a few days before adjournment but it was not acted upon further.

The $2,000,000 contribution by the State of Florida has made it possible to launch the Everglades National Park program of land purchase. The title situation in the Everglades, much of which is unsurveyed, is extremely complex. However, two key tracts in the process of development have been purchased. In addition, substantial progress has been made on clearing title to the approximately 4,000 acres of Royal Palm State Park. It is hoped that 1949 will see mutually satisfactory contracts entered into for the purchase of a major portion of the acquisition area.

Wind-up of recreational demonstration area transfers.—The transfer of three recreational demonstration areas to States, under authority of the act of June 6, 1942—Camden Hills to Maine, Mendocino Woodlands to Califonia, and Silver Creek to Oregon—during the past year virtually concluded the Service's program of disposing of 46 such areas in 24 States. Final disposition of only one area and part of another remains to be effected. Catoctin, in Maryland, site of the retreat of President Franklin D. Roosevelt and President Truman, for as long as it is used for this purpose, is scheduled for transfer to National Capital Parks. It would be transferred to the State of Maryland should its use as a Presidential retreat be discontinued. Approximately a third of the Custer area in South Dakota is to be transferred to the State upon enactment of State legislation authorizing conveyance of certain lands to the United States.

The recreational demonstration areas, which contained 397,056 acres, were acquired in 1934–35 at a cost of approximately $4,500,000 of National Industrial Recovery Act funds, and were developed with funds and manpower made available through various emergency agencies. In 1936, the Service was given full responsibility for their development and management. Except for a few of the areas acquired for addition to the National Park System, the projects were intended to be demonstrations of the possibilities of transforming lands no longer suitable for agriculture into recreational areas serving large population centers. Their development was planned primarily to provide facilities for organized camping for use by welfare and character-building agencies, but day-use facilities were also provided wherever practicable.

Disposition of recreational demonstration areas

[Acreage indicated by figures in parentheses]

Area	*Disposition*
Acadia, Maine (5,611)	Added to Acadia National Park by act of June 6, 1942.
Alexander H. Stephens, Ga. (940).	Transferred to State, Jan. 29, 1946.
Badlands, S. Dak. (43,500).	Included in Badlands National Monument by Proclamation of Jan. 25, 1939, pursuant to the act of June 26, 1936.
Beach Pond, R. I. (3,484)	Transferred to State, June 28, 1943.
Bear Brook, N. H. (6,436)	Transferred to State, May 12, 1943.
Blue Knob, Pa. (5,136)	Transferred to State, Feb. 1, 1946.
Blue Ridge, Va.-N. C. (10,585).	Included in Blue Ridge Parkway by act of June 30, 1936.
Bull Run, Va. (1,605)	Designated as a national historic site under the designation Manassas National Battlefield Park by Secretarial order of May 10, 1940.
Camden Hills, Maine (4,964).	Transferred to State, Mar. 5, 1948.
Catoctin, Md. (9,918)	Administered by National Capital Parks.
Cheraw, S. C. (6,825)	206 acres transferred to Fish and Wildlife Service, May 10, 1944; balance transferred to State, June 9, 1944.

Disposition of recreational demonstration areas—Continued

Area	*Disposition*
Chopawamsic, Va. (14,080).	Added to National Capital Parks System by act of Aug. 13, 1940. Transfer of approximately 5,000 acres to Department of the Navy authorized by act of June 22, 1948.
Crabtree Creek, N. C. (4,983).	Transferred to State, Apr. 6, 1943.
Cuivre River, Mo. (5,759)	Transferred to State, Nov. 19, 1946.
Custer, S. Dak. (20,404)	14,777 acres added to Wind Cave National Park by act of Aug. 9, 1946; remaining 5,627 acres will be transferred to State after enactment of State legislation authorizing conveyance of certain State lands to the United States.
Fall Creek Falls, Tenn. (15,777).	Transferred to State, Aug. 1, 1944.
French Creek, Pa. (6,198)	214 acres established as Hopewell Village National Historic Site by Secretarial order of Aug. 3, 1938; remaining 5,984 acres added to site by act of June 6, 1942. Act of July 24, 1946, reduced site to 848 acres; remaining 5,350 acres reverted to RDA status and were transferred to State on Mar. 31, 1947.
Hard Labor Creek, Ga. (5,804).	Transferred to State, Jan. 29, 1946.
Hickory Run, Pa. (13,386).	Transferred to State, Feb. 1, 1946.
Kings Mountain, S. C. (10,147).	3,972 acres included in Kings Mountain National Military Park by Secretarial order of July 11, 1940; balance transferred to State, May 30, 1944.
Lake Guernsey, Wyo. (1,753).	Transferred to Bureau of Reclamation, June 8, 1943.
Lake Murray, Okla. (2,228).	Transferred to State, Feb. 20, 1943.
Lake of the Ozarks, Mo. (16,148).	Transferred to State, Nov. 19, 1946.
Laurel Hill, Pa. (4,026)	Transferred to State, Feb. 1, 1946.
Mendocino Woodlands, Calif. (5,426).	Transferred to State, June 11, 1948.
Montgomery Bell, Tenn. (3,746).	Transferred to State, June 9, 1943.
Montserrat, Mo. (3,441)	Transferred to State, Nov. 19, 1946.
Oak Mountain, Ala. (7,805).	Transferred to State, Apr. 30, 1943.
Otter Creek, Ky. (2,445)	1,072 acres transferred to War Department, Aug. 29, 1944; remaining 1,373 acres, plus 395 acres surplus War Department lands acquired by Interior Department, transferred to City of Louisville, Oct. 15, 1947.
Pere Marquette, Ill. (2,522).	Transferred to State, May 7, 1943.
Pine Mountain, Ga. (3,032).	Transferred to State, Jan. 29, 1946.

Disposition of recreational demonstration areas—Continued

Area	*Disposition*
Raccoon Creek, Pa. (5,035).	Transferred to State, Feb. 1, 1946.
Roosevelt, N. Dak. (61,539).	Transferred to Fish and Wildlife Service, Feb. 25, 1946. 44,502 acres subsequently included in Theodore Roosevelt National Memorial Park by Public Laws 38, 620, and 631 (80th Congress); remaining acreage available for exchange to consolidate Federal holdings in the park.
St. Croix, Minn. (18,499)	Transferred to State, Sept. 27, 1943.
Shelby Forest, Tenn. (12,258).	Transferred to State, Aug. 1, 1944.
Shenandoah, Va. (10,129)	Added to Shenandoah National Park, June 6, 1942.
Silver Creek, Oreg. (4,093).	Transferred to State, June 26, 1948.
Swift Creek, Va. (7,605)	Transferred to State, May 31, 1946.
Versailles, Ind. (5,371)	Transferred to State, Apr. 20, 1943.
Waterloo, Mich. (11,830)	Transferred to State, June 15, 1943.
Waysides, S. C. (228) (6 areas).	Transferred to State, June 9, 1944.
Waysides, Va. (206) (6 areas).	Transferred to State, Mar. 26, 1943.
Winamac, Ind. (6,233)	Transferred to State, Apr. 20, 1943.
White Sands, N. Mex. (1,719).	Added to White Sands National Monument by act of June 6, 1942.
Yankee Springs, Mich. (4,197).	Transferred to State, June 15, 1943.

Threats to Parks and Monuments

Past reports have told of the pressure to break down national park policies, notably in the case of Jackson Hole National Museum and Olympic National Park.

Though no action was taken on the proposal to abolish Jackson Hole National Monument or to shrink the boundaries of Olympic National Park, legislation on both on these matters seems certain to be introduced and considered by the Eighty-first Congress. Related in character to these threats are several proposals to invade park areas with water impoundments, either by the Bureau of Reclamation or the Corps of Engineers. No less serious are the alien developments being imposed on such areas as Gettysburg National Military Park and Colonial National Historical Park because of the fact that lands of major historical importance inside these parks are still in private ownership and open to exploitation. It is pleasant, however, to record that the State of Virginia has appropriated $17,000 to be expended with matching Federal funds to acquire the valuable Stone House property, for addition to Manassas National Battlefield Park.

The Jackson Hole and Olympic controversies.—House bill 1330, which, as reported out of committee, would abolish the Jackson Hole National Monument, by transferring approximately 40,000 acres to

Grand Teton National Park and adding the rest to Teton National Forest, failed of passage in the last Congress. It was taken off the Consent Calendar of the House after being objected to on two different occasions, and did not come up again. A similar Senate bill 1951, and a proposal to abolish the monument through amendment of the Antiquities Act of 1906, embodied in Senate bill 91, were not considered.

Hearings on the several pieces of legislation relating to the boundaries of Olympic National Park were held at Lake Crescent last September by the House Committee on Public Lands. It was expected that there would be further hearings in Washington, D. C., in order that the viewpoint of individuals and organizations in the East might be presented. No further hearings were held, however, nor were any of the several bills reported out by the committee. Concurrent resolutions, introduced in the House and Senate comparatively late in the 1948 regular sessions of Congress, provided for a joint committee, composed of three members each from the two bodies, to determine what boundary reductions should be made. Neither was acted upon. It is apparent, however, that the endeavor to make extensive reductions will be renewed in the Eighty-first Congress.

That the Jackson Hole National Monument still stands—though handicapped by continuance of the prohibition against the use of appropriations to administer it as a monument; and that none of the Olympic boundary proposals were acted upon, is due to the active interest of conservationists from one end of the country to the other; and none were more active and effective than those of the West itself.

Dams versus parks.—A number of water development proposals seriously threaten the integrity of national parks. The National Park Service recognizes the desirability of fuller utilization, within the limits of long-term economic soundness, of the water supplies of the Nation and of effective measures for the control of floods. Many proposals for flood control, hydroelectric and reclamation impoundments, however, contemplate the invasion of parks and monuments, and the Service is obliged by law, by general public opinion, and by its own convictions, to defend these areas as vigorously as it possibly can, unless an overwhelming showing of national necessity can be made. In connection with many flood-control proposals, the Service shares with numerous conservation organizations serious doubts as to the permanent efficacy of such dam construction, and feels that more attention needs to be directed to remedying the primary causes of floods, the destructive denudation of forested watersheds, unsound agricultural practices, the failure to apply erosion controls, and conditions at the headwaters of streams. Conservationists and conservation groups have united in defending National Park System areas against construction of dams until there can be a full appraisal of their damaging effect in a weighing of this loss against the benefits claimed.

A legislative proposal before the Eightieth Congress would have provided for construction, by the Bureau of Reclamation, of the Bridge Canyon Dam on the Colorado River above Lake Mead. Its construction would mean that the inner canyon of Grand Canyon National Monument would be greatly reduced, seriously impairing the feature which was the primary reason for establishing the monument. At the maximum elevation of the proposed reservoir, 18 miles of Grand Canyon would be flooded along the park boundary.

Another and still more dangerous proposal is for the construction of a 54-mile tunnel, to divert the major portion of the Colorado's waters under the Kaibab Plateau to a power plant near the mouth of Kanab Creek, just above the headwaters of the proposed Bridge Canyon Dam. The flow of the River through the park—its most significant single feature—would be reduced to a small fraction of its normal volume.

Glacier National Park is likewise threatened. The Corps of Engineers is considering the construction of a dam at Glacier View, on the North Fork of the Flathead River, Mont., to which the National Park Service is strongly opposed. This opposition has been made clear by public announcement and by statements issued at the public hearing held under the auspices of the Corps at Kalispell, Mont., on May 25. The Service is supported in its stand by virtually every conservation organization in the country. There is, furthermore, a large volume of local opposition.

The proposed Glacier View Dam would flood more than 19,000 acres of superb wilderness area and destroy a major portion of the winter habitat of the park's big game animals. The effect on wildlife would, consequently, extend over an area of the park many times greater than the area to be flooded. Second possibly only to Yellowstone, Glacier is noted for the number and variety of its big game. Within the area to be flooded are approximately 8,000 acres of virgin forest, as fine as any the park contains.

In opposing the Glacier View project at the hearing, the statement from the Director of the National Park Service contained the following:

> Civilization is encroaching on the wilderness all over our land. What remains of it becomes increasingly precious to present-day Americans, and will be in even greater degree to Americans of the future. Here, threatened with permanent destruction, is an extraordinarily fine example of "Original America." We cannot afford, except for the most compelling reasons—which we are convinced do not exist in this case—to permit this impairment of one of the finest properties of the American people.

In the interest of protecting Mammoth Cave National Park, both the Department and the National Park Service have protested vigorously against the proposal of the Corps of Engineers to construct a flood-control dam at Mining City, Ky., on the Green River, which would cause flooding of a portion of Mammoth Cave, entailing great damage. The park was purchased by Kentuckians at a cost of approximately $3,000,000 and was accepted by the Federal Government on the understanding that its unique features would be fully protected.

Developments encroach on parks.—Insufficiencies of land ownership in the historical areas of the National Park System still present discouraging problems of adverse and undesirable use. At Gettysburg, for example, guns which formerly pointed across open fields, as they did during the battle, are now pointed squarely at a newly constructed residence. A community generally known as Slabtown still forms a wedge into the Yorktown Battlefield, in Colonial National Historical Park, crossing the first and second American parallels, works constructed by the Colonial forces in prosecuting the siege. Similar examples are to be found in other areas.

Progress in Research, Interpretation, and Information

One of the most important functions of the Service involves the activities of the naturalists and the historians in revealing to the public the meaning and significance of national park areas.

By making the most effective possible use of available funds and personnel, the National Park Service during the past year has made many noteworthy forward steps in interpretation and in the research on which satisfactory interpretive activities must be based. A corollary has been the increased use of the parks and monuments for research by universities and other outside groups and agencies—an activity from which the Service and the public benefit. Both in history and prehistory and in the natural sciences, Service-administered areas offer unique opportunities for research. Particularly valuable are the natural areas in which a primary obligation is the maintenance of normal relationships of plant and animal life. The areas in which these conditions continue to exist are becoming increasingly scarce, since elsewhere commercial development is rapidly changing the face of the American landscape.

Yosemite school reopens.—Important because of its influence on effective interpretation is the reopening of the Yosemite School of Field Natural History—the first held since before the war—which got under way late in June. Shortages of staff had extended its wartime suspension through 1946 and 1947 and while such continue this year, the great value of the school in providing the special training needed for natural history interpretive work in the National Park System induced the decision to resume operation, even though it was recognized that it would add greatly to the burden of the Yosemite naturalist staff.

The carefully selected students are being given full opportunity to participate in actual naturalist work with park visitors, campfire talks, conducted walks, etc., and receive a thorough grounding in fundamental Service policies and administrative practices.

Closely related in character was the Region Four naturalist conference held at Yosemite in April, the first such gathering in any region since 1941. It is planned to hold a similar conference in at least one region each year hereafter.

Archeology.—Though archeology is ordinarily considered to be concerned with prehistory, the most newsworthy archeological accomplishment of the Service during the past year was that at Fort Raleigh National Historic Site in North Carolina. There the second period of digging resulted in the definite determination of the location, extent and character of the fort built by the Raleigh colonists on Roanoke Island. This work, and the preliminary archeological explorations at Fort Frederica, Oglethorpe's southern outpost on the Georgia coast, at Whitman National Monument, at Fort Vancouver, authorized as a national monument, and at the Bynum site on the Natchez Trace Parkway, are the subjects of papers prepared for professional journals and are of considerable interest to archeologists. Articles dealing with the combined historical and archeological research on Jamestown Island, Colonial National Historical Park, have also been prepared for publication.

An archeological project carried on at Homestead National Monument, Nebr., last spring made possible the determination, beyond a reasonable doubt, of the Freeman cabin site on the "first homestead." Investigation begun in the basin to be inundated by Davis Dam, downstream from Hoover Dam, on the Colorado, was suspended last winter when the General Accounting Office ruled that the working fund set up by the Bureau of Reclamation could not be used for that purpose. This area is a part of the Lake Mead Recreational Area.

A research group from the University of Colorado faculty and museum personnel was organized, with collaborator status, to engage in archeological investigation and to gather biological and ecological data on Dinosaur National Monument, Utah and Colo. Their work will provide an inventory of the natural values that are imperiled by the proposal to dam the Green River at Echo Park, while cultural evidences of the early inhabitants of the Green and Yampa River Canyons will be preserved and studied.

Under departmental permit, Dr. Deric O'Bryan conducted an important archeological investigation, sponsored by the Gila Pueblo

Foundation, Globe, Ariz., at two sites in Mesa Verde National Park. The material removed from the sites, consisting of early Pueblo material covering a span of about two centuries, was cleaned, repaired, photographed, and studied at Gila Pueblo. Except for a small representative collection retained there in accordance with the terms of the permit, all the material has been returned to the park. The permit has been extended and other sites are being investigated this season. Other student parties, under competent direction, worked also at Bandelier and Chaco Canyon National Monuments.

Museums.—With a small, highly skilled staff, the Museum Branch, with a laboratory and workshop at Fort Hunt, Va., has been engaged mainly in the preparation of exhibit material for the fine museum building at Manassas National Battlefield Park, and for similar museums at Kings Mountain, Guilford Courthouse, and Chickamauga and Chattanooga National Military Parks.

Pending the erection of a structure specifically for the purpose, the Oconaluftee Ranger Station, near the main North Carolina entrance to Great Smoky Mountain National Park, was successfully converted last spring into an interim museum of pioneer culture. This museum provides the North Carolina portion of the park with an important focal point of interest. A temporary museum has also been established at Fort Raleigh National Historic Site.

Other items which mark definite progress in the Museum program include the completion of prospectuses for much-needed museums at Custer Battlefield National Monument, Mont., Chaco Canyon National Monument, N. Mex., and Fort Pulaski National Monument, Ga.; the completion of a colorful series of paintings on Indian Government and Seasonal Ceremonials, for the Bandelier National Monument, N. Mex., museum by Mrs. Pablita Velarde Hardin, noted artist from the Santa Clara pueblo; generous gifts of valuable historical material to the Morristown National Historical Park, N. J., museum by the Washington Association of New Jersey and Mrs. Paul Moore, of Convent, N. J.; the gift to Saratoga National Historical Park, N. Y., of a fine collection of relics pertaining to the Saratoga battles by Louis E. Follett, of Schuylerville; the signing of a contract for construction of the William H. Jackson wing of the museum at Scotts Bluff National Monument, for which funds have been donated by Julius Stone and by the American Pioneer Trails Association; and a start on the work of stabilizing the Cyclorama at Gettysburg, for which $10,000 was appropriated by Congress. The Cyclorama was badly in need of repairs when acquired by the Service in 1942, but none could be undertaken during the war years.

Stabilization of historic and prehistoric structures.—Although stabilization problems have not been wholly solved at such ancient structures as the mission at Tumacacori National Monument, Ariz., or the still older pueblo ruins of the Southwest, the past year has seen steady progress in arresting the deterioration of some of the most interesting and significant of these structures.

At Tumacacori, portions of the painted plaster on the church facade are so weakened by the deterioration of material underneath that conventional stabilization methods cannot be applied to them. However, extensive repairs have been successfully made elsewhere in the structure. All of the church exterior except two walls of the sacristy have been given permanent stabilization, and other related work is continuing.

Active stabilization work was carried on with satisfactory results at Casa Grande, Canyon de Chelly, Hovenweep, Aztec Ruins, and Bandelier National Monuments, and at Cliff Palace, Spruce Tree House and Square Tower House at Mesa Verde National Park, Colo.

At the beginning of the 1948 fiscal year, stabilization of the great Chettro Kettle ruin at Chaco Canyon National Monument, N. Mex., was 90 percent complete. Less than 2 months later a disastrous flood destroyed 25 rooms and put 6 to 8 feet of debris into all others that had been excavated below ground level. The rest of the year was spent repairing this damage—so far as it was repairable—and in completing small but urgent repairs at Pueblo Bonito and Pueblo Alto, in the same monument.

In addition, badly needed repairs were given several important historic structures. The ancient footings of the Castillo de San Marcos, badly eroded by tidal action, are being successfully stabilized. Groins have also been rebuilt to protect Fort Matanzas against wave action. Old Bedlam at Fort Laramie National Monument has undergone extensive repairs. Equally extensive repairs to the Bocock-Isbell House at Appomattox Court House National Historical Monument, for occupancy by the custodian, are also under way.

Informational publications.—As had been the case ever since the end of the war, funds for the printing of informational publications, so necessary to park visitors, fell far short of need. During the past year, every effort was made to spread the available publications funds, approximately $46,000, as far as they would go. Some items were cut in size to the point where at least a part of their intended usefulness was curtailed. Yet for a visitation in excess of 25,000,000 it was possible to provide only about 3,000,000 pieces; some major areas were without literature throughout much or all of the season of heaviest travel.

Although the increased printing funds for the 1949 fiscal year will not permit much, if any, relief for this situation during the present vacation season, they will be enough to permit somewhat more adequate supplies to be produced for the next travel year. The limiting factor on production is personnel, since the editorial staff of the Information Division is no greater than it was for a publications program of approximately one-third of the prospective 1949 volume.

Matters pictorial.—A contribution of funds by the Atwater Kent Foundation and of his highly expert services by Ted Phillips, for several years chief photographer for Burton Holmes, made it possible this spring for Mr. Phillips to embark on the making of a sound-and-color motion picture of Yosemite National Park. This picture, scheduled for final completion late this summer, will not only tell the fascinating geological story of the park but will also show the manner in which the area is administered by the Service and the ways in which it is used by the public.

The parks and monuments seem to appeal, more than ever before, to both professional and amateur photographers. Ansel Adams, working under a Guggenheim Foundation grant, has continued his comprehensive program of both black-and-white and color photography of the parks, including those in Hawaii and Alaska. Ralph E. Gray, one of the foremost amateur cinematographers, is making an extensive motion picture series which will deal largely with the national parks. Ray Garner, working under a grant from the Harmon Foundation, is continuing his program of producing "Portraits in Music" for which national park and monument color motion pictures provide the pictorial background. Numerous other commercial and noncommercial agencies are engaging in the production of pictures on national park subjects.

The Service would like to be in a position to produce, or arrange for the production of, a series of up-to-date motion pictures of the parks and monuments, of professional quality. However, neither its present nor its prospective means would permit that. It recognizes the value of motion pictures produced by or through other agencies, works as closely as possible with those who take them, and extends the fullest possible assistance, through the staffs of the Director's Office and the field services of the Service.

Closely related to motion-picture activities is a project, under negotiation at the end of the year, for the commercial production of "film strips" in color on a wide variety of park subjects, primarily for use in schools. Such material, accompanied by accurate printed information, seems likely to offer an effective and inexpensive means of reaching school and related audiences, groups which should have a good fundamental understanding of the people's park system.

Interpretive services.—Demands for interpretive services have increased at least in proportion to the increased number of visitors, but without a proportionate increase in interpretive personnel. Thus we have such situations as that at Spruce Tree Ruin, in Mesa Verde National Park, where one person must guard against vandalism and explain the ruin to as many as 300 persons in a 4-hour period. Groups accompanying ranger naturalists on guided walks are frequently so large that it is virtually impossible to provide them with satisfactory service.

In Washington during the past spring more than 5,000 school groups visited the Washington Monument and other points of interest in the National Capital Parks. Special provision was made to give orientation talks to these groups so that their time in the Nation's Capital could be spent to best advantage.

Concessions

One aspect of the work of the Service is particularly open to public notice, and if inadequate is quickly subject to adverse comment. This is the system of concessions under which hotels, lodges, meals, stores, and transportation are provided. Since the war such provision has fallen far behind the need and the demand.

Congressional and other criticism of the operation of concessions in the national parks resulted, as noted in last year's report, in the appointment of a five-man concessions advisory group by Secretary Krug, to make a detailed and objective study of all phases of the concession problem. This was of necessity a time-taking task. During its progress it was felt necessary to hold in abeyance decisions as to future policy, in order that, in reaching them, the Department might have the advantage of the group's study and the recommendations based upon it. Though this procedure was basically sound, one of its adverse effects was to leave present concessioners in a state of uncertainty as to the conditions under which they would be permitted to operate in future and, in particular, as to whether or not existing or already expired contracts would be renewed. This in turn has deterred them from embarking on extensive, and much needed, programs of modernization and expansion of facilities.

A final determination of the Department's policy in the near future and the framing of a type contract should make it possible to undertake negotiations on the 22 contracts which have already expired or which will expire at the end of this calendar year and, once these are settled, enable the concessioners to proceed with overdue construction, when materials and labor become available.

Advisory group approves major concession policies.—The concessions advisory group, after an intensive study of concession problems and practices extending over more than a year, submitted its report to Secretary Krug on February 19, 1948. In multilith form, this report has been given wide distribution and has been closely studied by Department and National Park Service officials preliminary to the formulation of a revised statement of the Secretary's concession policy, and a new concession type-contract to provide a basis for negotiating new contracts as present ones expire.

Particularly gratifying to the Service is the conclusion of the group that the policies and practices evolved through 31 years of experience with concessions operations in the national parks are in most major respects sound and in the public interest. The report, rendered after searching and dispassionate study of every phase of these operations by five highly qualified men, contains many constructive suggestions for improvement of methods of handling concessions and of service to the public. Some of these can be put into effect at once, while others, such as the recommendation that the Concessions Division be adequately staffed, are dependent on Congressional appropriations.

The following are major recommendations found in the report:

That, while preservation of the values for which the parks were created is a primary requirement, access should be restricted only to the extent necessary to assure this preservation; and that all developments should be as inconspicuous and as harmonious with their surroundings as possible.

That accommodations should be provided for the public in the parks only on the basis of definite need, since there is nothing in the act which established the National Park Service to indicate that Congress intended the parks to produce a revenue to the Government or to offer private enterprise an opportunity to make money.

That, in the long run, Government ownership, but not Government operation, of basic concession facilities is in the public interest and that Congress should establish a definite policy of acquiring and maintaining such facilities.

That contracts should be awarded to selected operators on the basis of known qualifications—not only as to adequate financing and business judgment, but as to sympathy with the objectives and policies of the National Park Service.

That in general the present policy of granting, subject to Government regulations, contracts to a single concessioner for all operations in a given area is sound in view of the large investments required in many national parks, the hazards involved in many concessions operations, and the need for adequate and continuous service to the public. The group found that past concessions have not yielded excessive profits.

That while "service at cost" (with a reasonable return on investment included as an item of cost) is recommended as sound in principle, it is not actually practicable; that a franchise fee should therefore be provided and should be levied against net profits; that the concessioner should be permitted a fair minimum return on investment (6 percent s suggested); and that the franchise fee should be levied, on an ascending scale, on profits in excess of the fair minimum return. The group recognized that in prosperous years, concessioners should be allowed a fair percentage of the extra profits to offset the occasional lean years.

"Many of the facilities provided by the Government, as well as the personnel, are taxed beyond capacity," the report declares. "All this results in situations for which the Service is often criticized but over which it has little control. The concessions advisory group feels that much of this criticism would not arise if the appropriations for the Service were more nearly commensurate with responsibilities placed upon it and the public service expected from it."

Since the report was issued, Secretary Krug has determined that, though satisfactory service by a concessioner would weigh heavily in decisions as to renewal of contracts, public notice of expired or expiring contracts is to be given and that proposals from others shall be given consideration.

At a hearing before the House Subcommittee on Public Lands in June, concessions policies, existing and proposed, were the subject of questioning of departmental and Service officials. Attention was particularly directed toward the proposal for Government ownership of basic concession facilities as a long-term aim and objective of the Department and the Service, and approved as such by the concessions advisory group. The reasons for advocacy of it were discussed at some length in the annual report for 1946. It may be added that public ownership of such facilities is established practice in the State parks of virtually every State in which they exist, and considered desirable by them for reasons in general identical with those which appear to justify Federal ownership of national park facilities.

Concessions Division staff insufficient.—The National Park Service, like the concessions advisory group, has long recognized the need of a greater degree of supervision over concession matters and of continuous study directed toward better service to the public. The Concessions Division should be in a position to analyze all financial aspects of the concessions, study the management methods applied to them, analyze the details of operations to determine trends of public use and demand in order to plan intelligently for the future, and supervise operations sufficiently to see that sanitary and safety measures are enforced and to make certain that the public is well and courteously served at all times.

This has never been possible because of the meager staff which must handle all phases of the Service's concern with concessions operation. Though repeatedly requested, there have never been granted sufficient funds for personnel to do the work required to keep the business current, to say nothing of conducting worthwhile studies, analyzing operations or giving adequate supervision. Even the audits of the concessioners' records, on which franchise fees are determined, are far from up-to-date; and this situation has been aggravated by the necessity of using auditors to a considerable extent to clear urgent administrative work concerned with concessions.

Many of the concessions advisory group's excellent recommendations cannot be carried out without additional appropriations. To base the approval of rates on the cost of providing service, for example, would require not only keeping audits current, but also study and analysis of detailed annual reports to ascertain which rates should be reduced, increased, or left undisturbed, the gathering of rate data in the vicinity of the parks and a determination as to whether the rate structures of concessioners were consistent with service furnished and with rates in the vicinity and with other concessions. For all these tasks; for satisfactory supervision of concessions operations; for the preparation of data with which to keep the Bureau of the Budget and the Congress informed on concession matters; and to perform the normal administrative functions required in connection with some 250 concessions, with an annual gross revenue of more than $25,000,000, there is a staff of 13 positions in all grades in the Director's Office and one auditor in each of the four regional offices. This force is wholly inadequate for the extensive and complex responsibilities resting on the Concessions Division.

Service of concessioners improves.—Though the volume of travel to the parks has shown a marked increase over last year, which was far higher than during any prewar year, it is gratifying to note that better service has been given the visitor. Concessioners have been able to enlist a better type of personnel, a greater percentage of their seasonal employees have had previous experience with them, and they have had less difficulty in obtaining needed materials and equipment. All of these factors have been reflected in improved service. Rates charged the public have been closely comparable to those charged for similar services elsewhere, and in many cases have been lower. There has been definite progress in rehabilitation and improvement of facilities, though they have not yet in all cases been brought up to standard; and little expansion has been possible.

Rehabilitation since the war has been hindered by shortages of materials, equipment, and labor, with some important materials still in short supply, and by short work seasons in the snow parks. Provisions for sanitation and safety have been stressed, however. Reference is made elsewhere to the various measures taken to assure greater safety from fire in the larger hotels throughout the system. Some needed sprinkler systems, unfortunately, must wait upon enlarged Government appropriations with which to install more adequate water supplies.

Rehabilitation and improvement of existing facilities, rather than additions to them, has been the Service's first objective. The Fred Harvey Co. has added hot and cold running water in some 90 cabins in the cabin camp on the south rim of the Grand Canyon and has added baths to 40 others. Some 60 cabins with bath at Lake, in Yellowstone National Park, begun before the war, are nearing completion after a long wait for plumbing fixtures. There has been some expansion in other areas, but of no great extent.

Plans are in progress for major concession developments at Thumb, in Yellowstone National Park and at Yosemite Lodge, Yosemite National Park. The character of the proposed Thumb development has been indicated elsewhere. In Yosemite, it is proposed to construct a new central unit at Yosemite Lodge, and to convert many of the present cabin-type sleeping accommodations into larger 2-story lodging units. At both locations, and at others where expansion is planned, the installations of utilities by the Government must be timed with the building by the concessioners.

Temporary concession employees given special training.—The average visitor makes little distinction between Government and concessioner employees. It is, therefore, particularly important to the Service, and the visitor, that those employees of the concessioners who come in contact with the public not only be trained to render courteous, intelligent service, but that they also possess at least basic information about the park in which they work, and about the National Park Service and the way it functions. Increased effort has been exerted during the past year by both concessioners and the Service to provide training along these lines, through numerous meetings, and a number of the concessioners have issued printed matter to supplement these. The intent is to reduce to a minimum justified complaints, based on lack of information or wrong attitude. This is by no means easy since it is necessary to train a large number of new employees each season. However, the return to the parks of more employees with previous experience, and the more intensive effort to train new employees has resulted in more intelligent, attentive, and considerate service to the public. Considering the tremendous numbers served, the number of complaints has been very low.

Expiring concession contracts.—This year found the Service with 22 concession contracts which have already expired or will expire before the end of the calendar year. Some of these expired during the war and have been extended on the original terms from year to year, because of the uncertainties of postwar conditions. Negotiations preliminary to the signing of new contracts were further postponed to await the results of the studies of the Concessions Advisory Group. Their report having been submitted and the major features of the Secretary's policy having been outlined, the Concessions Division is now proceeding with contract negotiations. In connection with expired or expiring contracts, an opportunity is being given other interested parties, as well as the current concessioners, to make proposals.

The Mount Rainier Operation.—Legislation (H. R. 2312) was introduced in the Eightieth Congress which, if approved, would authorize Government purchase of the assets of the Rainier National Park Co., which has supplied accommodations at Mount Rainier National Park since 1916. It was introduced on petition from the company which, having operated on the whole at a loss, is unwilling and unable to replace its present old and inadequate plant. Although hearings were held in the park last September and in Washington, D. C., in May and June by the Subcommittee on Public Lands of the House Committee on Public Lands, the committee took no action on the proposal.

The company's present contract expires on December 31, 1948. It was organized and financed by public spirited citizens of Seattle and Tacoma through the solicitation and encouragement of Stephen T. Mather, the first director of the National Park Service. It has made a considerable investment in the park and has rendered good service throughout the years.

Data have been prepared on the past operations of this concession and on the proposals for future development and operation, and efforts are being made to interest private capital in purchasing the existing plant, as provided in the present contract, and in providing the modernized and enlarged facilities which the park needs.

Reservoir Sites, Recreation, and Archeology

A relatively new function has added to the responsibilities of the National Park Service. At the request of the agencies concerned, for the past few years the Service has cooperated, on a very extensive scale, with the Bureau of Reclamation and the Corps of Engineers in identifying and evaluating the scenic, scientific, historical, and archeological features, as well as the recreational potentialities of reservoir sites. By agreement with the Smithsonian Institution, that agency attends to the archeological and paleontological phases.

Reports on the surveys and studies are submitted with appropriate recommendations to both the Bureau and the Corps. With the latter, generally no further assistance is required beyond occasional requests for review of master plans.

Reclamation, however, relies on the Park Service also for preparation of complete plans, supervision of construction, and negotiations with other agencies for operation and maintenance of recreational developments.

The creation of large bodies of water, particularly in semiarid regions where natural lakes are rare, profoundly affects the recreational habits of the neighboring community. Determination of the recreational suitability of a large number of sites, however, requires careful study. Estimates must be made of the number and kind of facilities needed. Plans for any new area must be integrated into a program which includes existing and proposed recreational areas of the community and of other Federal and State agencies.

With this as with many other tasks that the Service has been asked to undertake, the available staff is not adequate. During the year covered by this report, the Service was barely able to complete its scheduled program. Another year will bring greatly increased demands, due to the accelerated program of dam building, and yet, available funds will be smaller. Basin-wide recreational surveys, too long delayed because of the urgency of studying individual sites, should be started, but the necessary increase in working force is beyond realization. Furthermore, construction work and rising water pose the threat of irreplaceable loss of invaluable scientific data and material. For archeological excavation, which must be done now or never, adequate funds are urgently needed, and quickly. The Service did not seek the responsibilities involved in these studies and surveys, but feels that, if they are to be undertaken, they should be provided for in a manner in keeping with their importance.

The Missouri River Basin.—Continued studies of sites in the Missouri Basin resulted during the year in the production of 55 reconnaissance, project, and subbasin reports; 2 historical reports; an atlas of archeological sites within reservoir basins; and 27 evaluations of recreational benefits of reservoir sites. The Smithsonian Institution submitted 17 archeological and paleontological reports. Reports were submitted to the Corps of Engineers on the recreational potentialities of 5 reservoir sites in their program.

The Columbia River Basin.—During the latter months of the year, the Bureau of Reclamation's program required particular emphasis on the investigation of reservoir sites in the Columbia River Basin. Reports have been submitted to the Bureau on 9 reservoirs, with 11 more in preparation, and 3 to the Corps of Engineers. One master plan was completed. Nineteen reconnaissance reports, 25 project reports, and 15 master plans are due for completion this year, but cannot be completed without more funds and personnel.

Other basins.—Eleven reports were submitted to the Bureau of Reclamation on projects in other basins. Two cover reconnaissance of the Blue-South Platte and the Gunnison-Arkansas transmountain diversion projects. They involved investigation of 25 dam and reservoir sites. The Corps of Engineers was furnished reconnaissance and planning (review) reports on 27 reservoirs.

The Colorado River Report.—The Service report on the comprehensive survey of the recreational resources of the Colorado River Basin, initiated in 1941 under an interbureau agreement, was completed and is now being edited for publication in the near future.

River Basin archeology.—Field operations of the Smithsonian, carried on according to the terms of their cooperative agreement with the Service, included archeological surveys of 38 reservoir areas in 18 States, 14 in the Columbia Basin alone; with 68 paleontological surveys and 4 archeological surveys in the Missouri Basin. Other important reservoir areas covered were Clark Hill, Ga.; Fort Gibson, Okla.; and Whitney-McGee Bend, Tex.

Archeological excavation was conducted mainly in the Missouri River Basin. At Medicine Creek Reservoir, Nebr., bulldozers and road patrols were used for the first time in this country in such work, to strip 1 to 3 feet of overburden from aboriginal occupation sites. Excavations there produced significant new data on the pre-Columbian inhabitants of western Nebraska and revealed evidence that their cultural existence was much earlier than hitherto suspected. Excavations in the Birdshead Cave, Boysen Reservoir, Wyo., and on the Canadian River in New Mexico were also fruitful. Those at the Addicks Reservoir in Texas provided the first complete knowledge on the sequence of aboriginal culture in that region.

The existence of promising but unsurveyed archeological areas, revealed by the Smithsonian surveys, and the rich contributions to our knowledge of ancient peoples produced by the year's excavations, indicate something of the urgency of a continued and enlarged program for the salvage of archeological resources in the reservoir areas before they are inundated forever.

Reservoir development and management.—In July 1947, the National Park Service was designated by the Secretary of the Interior as the agent of the Bureau of Reclamation to plan and develop the recreational areas that have been or will be created by the impounded reservoirs of the Reclamation program, except those in national forests, which will be entrusted to the Forest Service. The Park Service will continue also to manage the areas adjudged to possess national significance. In addition, the Lake Texoma Recreational Area in Oklahoma and Texas continues under National Park Service management, by cooperative agreement with the Department of the Army.

Some idea of the magnitude of the Service's problems of development and management on these areas may be gained from the volume of attendance they attract. Lake Texoma is likely to show 2,000,000 visitors during the travel year, or more; Lake Mead and Coulee Dam together may have as many more. On all of them, development has not kept within hailing distance of demand, and staffs have been equally inadequate, particularly to provide necessary measures for the safety of users. This is a primary responsibility where large bodies of water are thrown open to public use.

The recreational areas differ in character and purpose from the parks and monuments, being generally of local or regional rather than national importance. Consequently the policies which guide their development and use must be different in a number of respects. Their development will be pointed more toward providing opportunities for intensive outdoor recreation. The principal activities will be those particularly suitable to them, such as swimming, boating, fishing, picnicking, camping, hiking, and winter sports. Facilities for games, sports, and other recreational activities not normally found in the national parks will be provided where suitable and where there is a demonstrated need. In general, priority of facility development will be based on service to the greatest number of persons. Vacation cabin sites will be leased if it can be assured that this use will not interfere with long-range developments needed for the general public; organized camping will be encouraged. Subject to sound conservation practices, hunting in accordance with State laws and regulations, grazing, and mining will be permitted.

The National Park Service does not aspire to be custodian of these areas. In addition to a few areas that may be considered to be of national significance, there are at present more than 50 smaller areas of less importance which possess valuable recreation-use possibilities. It is hoped that these possibilities will be realized, but the permanent management of these areas is properly a responsibility of State or local agencies. Their development will be conditioned on the agreement of such agencies to assume and carry out their permanent management, and their ability to do so. During the period of development, administration of these areas may in some cases have to be assumed temporarily by the Service.

Cooperation with the States.—The Service continued on a limited scale the advisory assistance to the States authorized by the Park, Parkway, and Recreational-Area Study Act of 1936. More than half the States requested, and were furnished, consulting service on one or more occasions. In addition the Service assisted the States by cooperating in the planning of reservoir areas upon which they may ultimately administer recreation, by informing them of the availability of surplus Federal properties of possible State park value, by participation in national, regional, and State conferences and by tabulating and distributing statistical data relating to State parks.

The Service supplied information and publications relating to parks and recreation to all inquirers as completely as available resources would permit. However, virtually all agencies and organizations below the State level requesting advice and assistance were referred to their State park agency or to some other appropriate organization. Inadequacies of funds and personnel aside, the Service believes that the States themselves should furnish such assistance to their political subdivisions.

Forest Service Cooperation in Land Use

A noteworthy and gratifying step in interbureau relationships was the agreement reached between the National Park Service and the Forest Service of the Department of Agriculture, providing for the integrated use of both park and forest lands in the Grandfather Mountain-Linville Gorge section of the Blue Ridge Parkway in North Carolina. This agreement was worked out in the field by representatives of the two services and is now in effect. It sets up a special administrative area of approximately 55,000 acres—some privately and some publicly owned—of which the National Park Service is to undertake to acquire some 7,500 acres near Grandfather and Grandmother Mountains and 5,500 acres on the Linville River, including the famous Linville Falls. The 6,700 acres of national forest land in the Linville Gorge is to be maintained as a "wild area," in which the primitive environment is to be retained. Special cutting regulations to maintain the aesthetic qualities of the forest are to be applied by the Forest Service on the remainder of the special area.

A memorandum of agreement between the two services also confirms the informal arrangement under which the National Park Service administers Cedar Grove, a part of the Sequoia National Forest adjoining Kings Canyon National Park. Under a similar memorandum, the Service will also administer the Manzanita camp ground, in Lassen National Forest, adjacent to Lassen Volcanic National Park.

It is a pleasure to record these fine, and typical, examples of the close and satisfactory working relationships between the two services.

Disposal of Surplus Federal Realty

Public Law 616, approved June 10, 1948, amends the Surplus Property Act of 1944, to provide for the disposition of surplus real property to States, political subdivisions, and municipalities for use as parks, recreational areas, and historic monuments. Properties desired for park and recreational areas may be conveyed at 50 percent of their fair value; those sought for historic monuments, at no cost. Such transfers, however, are subject to determination by the Secretary of the Interior that they are suitable and desirable for the use intended. The law specifices that historical monument determinations must be in conformity with recommendations of the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments.

Preliminary negotiations with the War Assets Administration revealed that more than 50 areas, of a total value exceeding $100,000,000, might be requested. The Secretary has designated the National Park Service to make the determinations. Procedures for doing so on a reimbursable basis have been developed. Subsequent to February 28, 1949, when WAA will cease to exist, such surplus properties will be disposed of by the Reconstruction Finance Corporation. It is anticipated that the Service will work with that agency in a similar manner.

Airports To Serve National Park Travel

The past year has been marked by gratifying progress in National Park Service-Civil Aeronautics Administration relationships, primarily with respect to the establishment of airports, to be located outside of the parks and monuments but designed to serve those who wish to travel to those places by air. An immediate objective of the Interior-Commerce Departmental Airport Committee, on which the Service is represented, is to seek amendment of the Federal Airport Act of 1946 to permit Service participation with the Civil Aeronautics Administration in the sponsorship of needed facilities beyond park boundaries, and to select locations for these facilities. The program also envisions the printing of major park and monument locations on aeronautical flight maps, a determination of flight elevations to be permitted over park areas and the promulgation of the necessary regulations to give them effect, training of Service field personnel in flight regulation enforcement, and close cooperation with CAA on these and related matters. It is gratifying to note that there are no official differences of opinion between the two Departments on any of these matters at this time.

From the Service standpoint, the proposed amendment of the Airport Act is particularly desirable. At present the act limits Service participation in airport development to those which might be established inside park and monument boundaries. The Service has steadfastly opposed such developments, for reasons which have been set forth in detail in previous reports.

Soil and Moisture Conservation

In areas primarily of historical or archeological significance or those in which effort to halt and heal destructive processes started by man is justified, the Service has carried on a varied program of soil and moisture conservation for the past several years. The work of the past year included such diverse projects as the 15,000-willow planting to retard erosion in the arroyo of Chaco Canyon National Monument; the leasing of 500 acres of the Chickamauga battlefield for carefully controlled agricultural use; the seeding, liming, and fertilizing of extensive areas of worn fields at Mammoth Cave National Park; the sowing of 45 acres at Kennesaw Mountain National Battlefield Park with sericea lespedeza; surveys undertaken to map out a complete program of erosion control on the shores of Lake Texoma, in Texas and Oklahoma, where this destructive process is being hastened by heavy use; and the adoption and enforcement of soil-stabilization practices on the Natchez Trace and Blue Ridge Parkways and at Vicksburg National Military Park.

Funds for soil and moisture conservation work are allocated to the Service by the Department, from moneys appropriated for that purpose, and on the basis of carefully planned projects. The Service's share of these funds in 1948 was $80,000.

The Wildlife of the National Parks

National park areas are wildlife sanctuaries, in which all species are protected and exhibited in their natural environment, subject only to such degree of management as may be necessary to control overpopulations or to prevent the crowding out of vanishing species. The wildlife resources of the parks—of great interest both to the layman and the scientist—are not receiving the protection which should be given them, for the reason that park staffs are not adequate to provide it, or to carry out all necessary management measures. Furthermore, additional trained biologists are needed to carry on the field studies and to furnish technical guidance for sound management programs.

Though the wildlife program of the Service is thus handicapped, several steps have been taken during the past year which denote definite advances. In order to restore species once native there, whitetail deer and turkeys have been restocked, apparently with success, at Mammoth Cave National Park, with the aid of the State of Kentucky and the Fish and Wildlife Service of the Department of the Interior. At Big Bend National Park, the Texas Game, Fish and Oyster Commission cooperated with the Service last winter in stocking the park with 54 head of pronghorn antelope, a fine animal which formerly ranged there.

Some reductions necessary.—On the other hand, certain species are in oversupply in several of the areas and in some of these reductions have had to be made; in others it will probably be necessary sooner or later to assert some controls over numbers which have increased—natural controls having been eliminated—beyond the capacity of the natural food supply. The elk of Glacier National Park, as well as both mule and whitetail deer, exceed the carrying capacity of the range. Here efforts are being made to effect reductions through hunting outside the park. Isle Royale's moose are increasing and apparently are due to reach a peak before long.

The black bear and gray squirrel populations of Great Smoky Mountains National Park have been reduced radically. There shortages of food within the park drove them outside to seek it, and considerable numbers were killed by hunters.

Wildlife reductions have been made at Yellowstone National Park to conserve the over-used winter range. Hunters killed 970 elk north of and outside the park and 34 were shipped out alive from the park, leaving about 8,000 animals in the northern herd. The Lamar area herd of bison was reduced to 300 by killing 181 and shipping out 54 alive. Fifty-eight antelope were removed by live-trapping by the Montana State Game Department, bringing the herd down to about 400. Because of limited range, four head of bison at Platt National Park were also disposed of.

In Sequoia National Park, 50 mule deer were destroyed as a restoration measure to meet a long-standing winter range problem.

The disease-control program was continued with the assistance of the Fish and Wildlife Service. All buffalo calves at Wind Cave National Park were vaccinated against brucellosis and all adults were tested for the disease. Positive reactors and definite suspects were eliminated, together with all free-ranging animals that could not be examined. Pathological examinations were begun to determine if the deer, antelope, and elk of the park are free from the disease. In Yellowstone, testing and vaccinating the bison of the Lamar herd was continued.

Burros, *goats*, *pigs*, *et al.*—The burro problem is serious at Lake Mead recreational area and Death Valley National Monument. If the number of burros at Lake Mead is not kept down, the effect on bighorns and some other native species will be disastrous. An estimated 500 feral burros are in Death Valley, where 162 were killed and 67 horses were removed in 1947.

Feral goats and pigs continue to make the protection of native wildlife difficult and far from effective in Hawaii National Park. The destruction of 2,064 goats and 108 pigs in the Kilauea-Mauna Loa section, on the island of Hawaii, was reflected in noticeable recovery of vegetation in pressure areas, though satisfactory control has by no means been attained.

In the Haleakala Section, island of Maui, the destructiveness of these animals is even more serious. Though 375 goats and 16 pigs were killed as a result of drives in which friends of the park donated their services, this reduction was manifestly inadequate. Constant patrol is necessary to prevent damage to the Silversword, one of the most interesting and valuable plants of the park. Parts of the crater show ever-increasing signs of goat pressure. "All living trees are plimsol-lined to a height goats can reach by standing on their hind legs," the superintendent reports. "No reproduction of trees is possible; rare shrubs are suffering and younger trees are dying off as a result of barking by goats."

Dall sheep increase at Mount McKinley.—Of the long-standing wolf-Dall sheep problem at Mount McKinley National Park, the superintendent writes:

"The wolf-sheep relationship continues favorable. Wolves are in reduced numbers and sheep are trending upward. Of the authorized 15-wolf reduction, 9 have been taken."

While he notes that the ratio of lambs to ewes this year is below that of 1947, he adds that lambs are common, and attributes the reduced reproduction to the extremely heavy snowfall of April just before the lambing season. "All sheep appear in good condition since snow has disappeared from the feeding grounds," he adds, "and they are often seen from the Park Highway as they commonly were a few years ago."

The superintendent also records a mass migration of caribou in July 1947 near Camp Eielson, and in early June of this year thousands of the animals were scattered for several miles on both sides of the East Fork River.

Birds as well as beasts present problems of protection. In Hawaii, many birds, including the nene and the Hawaiian owl, are objects of concern. In the case of the owl, the steady increase in number of mongoses, an introduced species, may be a determining factor. The introduced mynah birds have multiplied and their parasites are dangerous to other birds.

Though there were fewer cygnets than in 1946 or 1944, the 62 trumpeter swans counted in Yellowstone National Park in August last year represented a slight increase over the figures for either of the two previous years. This splendid bird is just about holding its own. In the park, the species probably has filled the suitable habitats and so has attained its maximum population.

Mammal census.—The populations of the larger mammals inhabiting the National Park System are estimated as follows: Whitetail deer, 4,500; mule deer, 26,000; blacktail deer, 3,000; barren ground caribou, 15,000; elk, 25,000; moose, 1,700; antelope, 1,000; bighorn sheep, 2,600; mountain goat, 1,400; and bison, 1,200.

Promotion of Public and Employee Safety Intensified

With the parks used by millions of people, the responsibility of the Service for the safety of the public and employees has become a matter of great concern. The effective organization of safety committees in each of the four regional offices of the Service and in the larger field offices, for analysis of accident reports and promotion of safety; the completion of automatic sprinkler systems in two hotels in Glacier National Park and two in Yellowstone; structural improvements in several others and restrictions on the use of certain hotels for greater safety from the hazards of fire; cooperation with the United States Coast Guard in matters of safety on navigable waters under Service administration, and the adaptation of their requirements to apply to waters not classed as navigable; joint surveys with the Coast Guard to determine needed navigation aids at Lake Texoma recreational area—all of these indicate the variety of safety problems with which the National Park Service is concerned and the manner in which solutions, looking to a decrease in accidents to visitors and employees alike, are being sought.

It should be noted that although the safety needs at Lake Texoma were determined, no funds were available to meet them. The large artificial lakes of the four recreational areas administered by the Service and a number of natural lakes in the parks and monuments, of which Yellowstone Lake is the largest, involve dangers in connection with the use of water craft, particularly small boats, with which the Service cannot cope satisfactorily with present personnel and equipment, although it has benefited materially during the past 2 years from transfers of surplus boats of various sizes. With seven drownings at Lake Mead up to mid-May; with nine in Yellowstone National Park during the 1947 season, of which five were in Yellowstone Lake; with similar casualties at Lake Texoma recreational area and Rocky Mountain National Park, the Service is fully mindful of its obligation to protect the public, and is making every possible effort to meet it. There is ample indication of the need of modern navigational devices, better rescue equipment, more frequent patrol with better emergency facilities and, in some places, possibly more rigid restrictions as to size and equipment of craft permitted on waters under National Park Service control.

Acadia and Sequoia Forest Fires

Nearly one-third of the area of Acadia National Park was burned over and 14 park structures were destroyed in the fire which swept over more than 17,000 acres of Mount Desert Island last fall. The greatest loss was the forest cover. Since in many places the soil was burned away to bare rock, soil replacement by the slow processes of nature will take many years. Recovery of the forest cover will take many years more.

To fight the fire, which started outside the park, Service personnel were brought in from a number of other parks and offices. In addition, invaluable assistance was given by the United States Air Force and numerous other national and local organizations.

To meet the costs of suppression, replace facilities destroyed, reduce fire hazards resulting from burned forest cover, and for cleanup and reforestation, Congress provided an emergency appropriation of $400,000.

Two difficult-to-fight fires occurred in Sequoia National Park, one in August and one in September, the first covering 350 acres, the second 375. The August fire, on Moro Creek, was classed as incendiary. However, the case against a Government trail worker, cited by the local court to trial before the United States District Court, was dismissed by the United States attorney before coming to trial, because of his decision that the evidence was not sufficient to convict.

Airplane Crashes in National Parks

On October 24, 1947, a United Air Lines DC–6 plane carrying 52 persons caught fire in the air some 15 or 20 miles from Bryce Canyon National Park. The pilot attempted to make the Bryce Airport but, only seconds away from the field, crashed in the head of Tropic Canyon, within the park. All 52 aboard were killed instantly—a death toll exceeded in only one other instance in aviation history. The crash posed unusual and pressing problems for all personnel of the park, but their handling of the situation drew praise from the Civil Aeronautics Administration, the air lines, and all concerned.

Another crash occurred on the high slopes of Mount Rainier. Assistant Chief Ranger William J. Butler of Mount Rainier National Park, on July 21, 1947, in the course of a search to which he had been devoting every possible hour of his days off, discovered on the upper South Tahoma Glacier a long missing plane—a Marine transport plane which had disappeared on December 10, 1946, with 32 men aboard. The Navy was immediately notified of the find. Investigations, carried on under conditions of great hazard, resulted in the recovery of some records, but no trace of the personnel was found. On August 18, after the snow had melted considerably, three members of the park staff were able to reach the scene of the wreck and reported finding several bodies. An investigation was made by Navy, Marine, and Army ground forces, and representatives of mountaineering organizations to determine the advisability of attempting to remove the bodies. The final decision was to leave them in the glacier, since it was apparent that the attempt to remove them would be an unjustiiably dangerous undertaking. Memorial services for the men lost n the crash were held at Round Pass, overlooking the South Tahoma Glacier, on August 24. Twelve of the bereaved parents were present.

Assistant Chief Ranger Butler, although eligible to accept the $5,000 reward offered for finding the plane, declined it. Letters of commendation were sent him by Secretary Krug and the Director, and a "superior accomplishment" pay increase for him was approved shortly hereafter. He was also awarded a Distinguished Public Service Certificate by the Navy and a Distinguished Service Medal by the Department of the Interior.

When Nature Goes on a Rampage

Three times, in as many places, during the past year, disaster struck and caused serious damage in Service-administered areas. At Mount Rainier National Park, on October 2, 1947, a flood which originated high up in the Kautz Creek Valley resulted in the destruction of about a mile of the lower end of the Kautz Glacier, devastated at least 600 acres of forest, washed out approximately a half mile of the Nisqually entrance highway, and then covered its course with up to 17 feet of mud, boulders, and trees. Downstream it caused considerable damage to park structures and to private property outside the park. It also demolished power and telephone lines. Park headquarters was marooned for several days. Using equipment borrowed from several sources, an emergency outlet road was constructed to connect up with a private logging road. By the end of October the situation was partly stabilized; a temporary graveled road across the inundated area was open by November 10.

On the same day high waters on the upper Nisqually River damaged the Glacier bridge and destroyed two 5-ton dump trucks.

At Zion National Park, on the night of November 22, 1947, a huge segment of the cliff above the utility and warehouse area broke loose. One mass of nearly 900 tons of rock smashed four items of heavy equipment before coming to rest squarely on a truck tractor, crushing it 10 feet into the ground and rupturing a water line. A 60-ton rock crashed through a building and demolished a brand-new pickup truck. Total damage was estimated at $20,000.

Chettro Kettle, one of the largest and most notable of the prehistoric pueblos in Chaco Canyon National Monument, N. Mex., was seriously damaged as a result of rains of cloudburst proportions on August 22 and 23, 1947. Choked by waterborne debris, the waters were diverted during the night and were dammed along the highest section of the 470-foot straight-back wall of the pueblo. About 40 feet of this wall, 17 to 23 feet in height, collapsed under the pressure of the waters. Twenty-two of the adjacent deep excavated rooms were filled with debris.

Award for Jefferson National Expansion Memorial Design

A 590-foot stainless steel arch is the central feature of the design for the development of the Jefferson National Expansion Memorial, on the St. Louis Waterfront, for which the Memorial Association awarded the first prize to Eero Saarinen of Michigan, in a decision announced on February 18, 1948. Mr. Saarinen has been commissioned by the association to prepare a scale model for the use of the United States Territorial Expansion Commission, an agency created by the Congress, upon whose recommendation Secretary Krug has approved the winning plans.

The Advisory Board

Mr. Bernard DeVoto, distinguished author, historian and conservationist, was appointed to membership on the Advisory Board on National Parks, Historic Sites Buildings, and Monuments following the death of Dr. Clark Wissler, who had rendered notable service to the board during his many years of membership.

The full Board held its first postwar meeting in Washington April 28 to 30, 1948, with 9 of its 11 members present.

United States Travel Division Reactivated

Inactive during the war, the United States Travel Division (formerly the U. S. Travel Bureau) was reestablished during 1948, with an appropriation of $75,000. James L. Bossemeyer, who had been supervisor of the western office of the Travel Bureau in San Francisco before the war, was appointed Chief of the Division in August 1947.

It was decided at the outset that, due to budgetary limitations, only one office would be operated, to be a part of the Director's Office in Washington, D. C. To assist in the formulation of a completely new program and in its subsequent operation, an advisory committee was appointed by Secretary Krug in accordance with a provision of the basic act of 1940 which authorized travel promotion as a function of the National Park Service. The committee, as it convened for its first meeting on February 5 and 6, 1948, included Russell E. Singer, executive vice president, American Automobile Association, chairman; Charles A. Horrworth, executive vice president, American Hotel Association; W. Bruce Macnamee, executive assistant to the president, National Federation of American Shipping; M. F. Redfern, vice president for traffic, Air Transport Association of America; Hugh Siddall, chairman, Transcontinental Passenger Association, representing the Association of American Railroads; L. H. Ristow, chairman, National Bus Traffic Association, representing the National Association of Motor Bus Operators; Robert O. Swain, Department of State; John H. Sieker, Department of Agriculture; Paul H.

Jordan, Department of Commerce; E. H. Cox, Interstate Commerce Commission; Stephen C. Manning, Jr., United States Maritime Commission; and George W. Burgess, Civil Aeronautics Authority.

The untimely death of Mr. Siddall on June 27, 1948, led to the interim appointment of M. F. Dolan, of the Association of American Railroads, pending the designation of successor to Mr. Siddall.

Because of the importance of close cooperation with the National Association of Travel Officials, the Secretary also appointed four collaborators from that organization; Everett F. Greaton, Maine Development Commission; J. Herbert Walker, Pennsylvania Vacation and Recreation Bureau; Roy C. Beckman, Florida State Advertising Commission; and Don Thomas, All-Year Club of Southern California.

The Travel Division is prohibited by law from engaging in activities competitive with private travel agencies and consequently could not provide travel services to individuals, even if funds and staff permitted. Its great opportunities for usefulness are in the provision of services to the travel industry designed to produce ultimate benefits both for the industry and the traveler, and in the promotion of travel into the United States from other countries. The program agreed upon for it is pointed chiefly in those two directions.

The legislation under which the Division functions specifically allocates its activities to the National Park Service. Although it has always served the whole travel field and has been meticulous in avoiding favoritism toward the National Park System, it has been suspect among many individuals and agencies because of its connection with the Service. Convinced that it could function more effectively as a separate agency in the Department, the National Park Service took the initiative in urging action in that direction. The Department has urged enactment of legislation introduced last spring which would convert the present Travel Division into a bureau of the Department of the Interior.

Director's Office Back in Washington

The "exile" of the Director's Office from the Seat of Government to Chicago, which began as a war measure in September 1942, was ended during the latter part of October 1947, when the office was reestablished in the Interior Building in Washington. Separation from the Office of the Secretary, from other bureaus of the Department, and from the many other Government offices with which it is desirable to maintain close relationships; the delays in the accomplishment of Service business which resulted from it; and the frequent travel between Chicago and Washington were a severe and expensive handicap, now happily ended.

During the more than 5 years that the office was in Chicago, the small liaison office maintained in Washington was ably headed by Associate Director Arthur E. Demaray. Mr. Demaray's exceptional knowledge of Service policy and his mature, level-headed judgment peculiarly fitted him for that difficult and exacting assignment and did much to minimize the difficulties of the long-enforced separation.

Despite the fact that this report has dealt extensively with handicaps that confront the Service, particularly the inadequacy of funds for the performance of functions prescribed by law and expected by the public, the National Park Service looks with satisfaction upon the many advances made in the past year. Not only the unprecedented number of visitors, but also the widespread favorable comment by the press of the country on the way in which the Service is doing its work, encourages the thought that the National Park System is taking its proper place in the cultural life of the Nation.

Areas administered by the National Park Service, acreage and number of visitors, June 30, 1948

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1947–June 30, 1948
NATIONAL PARKS				
Acadia	Maine	28, 308. 35	381, 683	438, 644
Big Bend	Texas	691, 338. 95	16, 033	35, 098
Bryce Canyon	Utah	36, 010. 38	132, 461	166, 136
Carlsbad Caverns	New Mexico	45, 526. 59	383, 261	422, 226
Crater Lake	Oregon	160, 290. 33	277, 527	359, 314
Everglades	Florida	271, 007. 80	(1)	(1)
Glacier	Montana	997, 247. 85	210, 735	331, 813
Grand Canyon	Arizona	645, 295. 91	533, 306	620, 875
Grand Teton	Wyoming	94, 892. 92	135, 676	145, 040
Great Smoky Mountains	Tennessee-North Carolina.	461, 003. 79	1, 136, 604	1, 277, 846
Hawaii	Territory of Hawaii	173, 404. 60	352, 864	409, 331
Hot Springs	Arkansas	1, 019. 13	293, 706	305, 299
Isle Royale	Michigan	133, 838. 51	6, 802	7, 961
Kings Canyon	California	452, 904. 82	239, 129	239, 262
Lassen Volcanic	do	103, 269. 28	129, 596	147, 458
Mammoth Cave	Kentucky	50, 584. 58	172, 099	190, 059
Mesa Verde	Colorado	51, 017. 87	42, 837	54, 855
Mount McKinley	Alaska	1, 939, 319. 04	1, 557	4, 477
Mount Rainier	Washington	241, 524. 77	971, 052	860, 335
Olympic	do	846, 718. 71	142, 429	188, 183
Platt	Oklahoma	911. 97	468, 203	740, 580
Rocky Mountain	Colorado	252, 788. 28	812, 278	954, 779
Sequoia	California	385, 100. 13	349, 581	354, 481
Shenandoah	Virginia	193, 472. 98	765, 701	887, 646
Wind Cave	South Dakota	26, 582. 75	83, 370	103, 467
Yellowstone	Idaho-Montana-Wyoming.	2, 213, 206. 55	827, 032	941, 578
Yosemite	California	756, 440. 62	713, 413	735, 120
Zion	Utah	94, 241. 06	233, 155	285, 728
Total		11, 347, 268. 52	9, 812, 090	11, 207, 591
NATIONAL HISTORICAL PARKS				
Abraham Lincoln	Kentucky	116. 50	52, 564	68, 742
Chalmette	Louisiana	33. 25	73, 740	51, 933
Colonial	Virginia	7, 233. 46	578, 709	691, 744
Morristown	New Jersey	958. 37	284, 716	313, 365
Saratoga	New York	1, 865. 45	47, 738	54, 350
Total		10, 207. 03	1, 037, 467	1, 180, 134

See footnotes at end of table.

Areas administered by the National Park Service, acreage and number of visitors, June 30, 1948—Continued

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1947–June 30, 1948
NATIONAL MILITARY PARKS				
Chickamauga and Chattanooga	Georgia-Tennessee	8, 149. 36	240, 057	271, 526
Fort Donelson	Tennessee	102. 54	32, 505	32, 724
Fredericksburg and Spotsylvania	Virginia	2, 420. 71	99, 268	107, 043
Gettysburg	Pennsylvania	2, 463. 46	523, 908	657, 050
Guilford Court House	North Carolina	148. 83	36, 998	36, 190
Kings Mountain	South Carolina	4, 012. 00	30, 859	32, 813
Moores Creek	North Carolina	30. 00	3, 767	4, 202
Petersburg	Virginia	1, 324. 62	110, 621	138, 383
Shiloh	Tennessee	3, 729. 26	268, 971	275, 276
Stones River	do	323. 86	22, 520	5, 475
Vicksburg	Mississippi	1, 323. 56	25, 924	33, 299
Total		24, 028. 20	1, 395, 398	1, 593, 981
NATIONAL BATTLEFIELD PARKS				
Kennesaw Mountain	Georgia	3, 094. 21	33, 295	41, 362
Richmond	Virginia	684. 44	23, 725	26, 100
Total		3, 778. 65	57, 020	67, 462
NATIONAL MEMORIAL PARKS				
Theodore Roosevelt	North Dakota	58, 341. 26	(1)	[2] 4, 563
NATIONAL MONUMENTS				
Ackia Battleground	Mississippi	49. 15	(1)	(1)
Andrew Johnson	Tennessee	17. 08	23, 482	24, 496
Appomattox Court House	Virginia	968. 25	22, 050	25, 600
Arches	Utah	33, 769. 94	3, 080	6, 807
Aztec Ruins	New Mexico	27. 14	11, 929	13, 886
Badlands	South Dakota	122, 972. 46	244, 691	345, 712
Bandelier	New Mexico	27, 048. 89	22, 055	26, 710
Big Hole Battlefield	Montana	200. 00	2, 303	2, 585
Black Canyon of the Gunnison	Colorado	13, 176. 02	18, 184	23, 710
Cabrillo	California	. 50	[3] 71, 365	382, 447
Canyon de Chelly	Arizona	83, 840. 00	2, 041	2, 021
Capitol Reef	Utah	33, 068. 74	(1)	(1)
Capulin Mountain	New Mexico	680. 42	24, 960	30, 600
Casa Grande	Arizona	472. 50	34, 041	36, 837
Castillo de San Marcos	Florida	18. 51	260, 985	266, 169
Castle Pinckney	South Carolina	3. 50	(1)	(1)
Cedar Breaks	Utah	6, 172. 20	22, 663	29, 228
Chaco Canyon	New Mexico	18, 039. 39	1, 337	1, 107
Channel Islands	California	1, 119. 98	(1)	(1)
Chiricahua	Arizona	10, 529. 80	15, 161	13, 916
Colorado	Colorado	18, 120. 55	44, 672	58, 596
Craters of the Moon	Idaho	47, 210. 67	21, 491	28, 007
Custer Battlefield	Montana	765. 34	50, 706	60, 237
Death Valley	California-Nevada	1, 850, 565. 20	157, 303	161, 359
Devil Postpile	California	798. 46	(1)	(1)
Devils Tower	Wyoming	1, 193. 91	36, 301	41, 214
Dinosaur	Colorado-Utah	190, 798. 49	7, 509	10, 222
El Morro	New Mexico	240. 00	1, 899	1, 672
Father Millet Cross	New York	. 01	(1)	(1)
Fort Frederica	Georgia	74. 53	34, 946	47, 722
Fort Jefferson	Florida	[4] 86. 82	8, 778	7, 053
Fort Laramie	Wyoming	214. 41	11, 635	12, 159
Fort Matanzas	Florida	227. 76	13, 260	13, 211
Fort McHenry	Maryland	47. 64	504, 242	458, 416
Fort Pulaski	Georgia	5, 427. 39	(5)	35, 074
Fort Sumter	South Carolina	2. 40	(6)	(1)
Fossil Cycad	South Dakota	320. 00	(1)	(1)
George Washington Birthplace	Virginia	393. 68	37, 176	40, 000
Gila Cliff Dwellings	New Mexico	160. 00	(1)	(1)
Glacier Bay	Alaska	2, 297, 456. 27	(1)	(1)
Grand Canyon	Arizona	196, 051. 00	172	137
Gran Quivira	New Mexico	450. 94	2, 286	2, 266
Great Sand Dunes	Colorado	35, 908. 19	10, 790	15, 989
Holy Cross	do	1, 392. 00	(1)	(1)
Homestead	Nebraska	162. 73	1, 072	2, 731
Hovenweep	Utah-Colorado	299. 34	122	156
Jackson Hole	Wyoming	173, 064. 62	(1)	(1)
Jewel Cave	South Dakota	1, 274. 56	10, 039	15, 276
Joshua Tree	California	655, 961. 33	47, 959	60, 671
Katmai	Alaska	2, 697, 590. 00	(1)	(1)
Lava Beds	California	46, 027. 56	30, 737	33, 768
Lehman Caves	Nevada	640. 00	3, 808	5, 297
Meriwether Lewis	Tennessee	300. 00	12, 348	13, 229

See footnotes at end of table.

Areas administered by the National Park Service, acreage and number of visitors, June 30, 1948—Continued

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1947–June 30, 1948
NATIONAL MONUMENTS—continued				
Montezuma Castle	Arizona	783.09	18,528	25,495
Mound City Group	Ohio	57.00	[7] 20,849	34,299
Muir Woods	California	424.56	277,557	282,469
Natural Bridges	Utah	2,649.70	959	1,190
Navajo	Arizona	360.00	368	405
Ocmulgee	Georgia	683.48	28,716	27,469
Old Kasaan	Alaska	38.00	(1)	(1)
Oregon Caves	Oregon	480.00	77,885	80,938
Organ Pipe Cactus	Arizona	328,161.73	77,490	94,449
Perry's Victory	Ohio	14.25	27,500	41,253
Petrified Forest	Arizona	85,303.63	306,576	340,098
Pinnacles	California	12,817.77	17,702	19,638
Pipe Spring	Arizona	40.00	949	743
Pipestone	Minnesota	115.60	3,193	5,143
Rainbow Bridge	Utah	160.00	(1)	(1)
Saguaro	Arizona	53,669.24	16,098	19,867
Scotts Bluff	Nebraska	2,196.44	53,642	45,884
Shoshone Cavern	Wyoming	212.37	(5)	(5)
Sitka	Alaska	57.00	1,799	6,735
Statue of Liberty	New York	10.38	543,548	537,171
Sunset Crater	Arizona	3,040.00	11,946	20,699
Timpanogos Cave	Utah	250.00	53,109	54,492
Tonto	Arizona	1,120.00	16,338	15,761
Tumacacori	do	10.00	22,718	26,425
Tuzigoot	do	42.67	12,057	16,900
Verendrye	North Dakota	253.04	(1)	(1)
Walnut Canyon	Arizona	1,641.62	19,179	20,613
Wheeler	Colorado	300.00	(1)	(1)
White Sands	New Mexico	140,247.04	89,493	106,134
Whitman	Washington	45.84	(1)	(1)
Wupatki	Arizona	34,853.03	3,489	4,999
Yucca House	Colorado	9.60	11	93
Zion	Utah	33,920.75	(1)	(1)
Total		9,279,368.10	3,531,277	4,185,655
NATIONAL BATTLEFIELD SITES				
Antietam	Maryland	183.32	31,970	32,205
Brices Cross Roads	Mississippi	1.00	(1)	(1)
Cowpens	South Carolina	1.00	1,217	1,419
Fort Necessity	Pennsylvania	2.00	76,986	80,096
Tupelo	Mississippi	1.00	(1)	(1)
White Plains	New York		(1)	(1)
Total		188.32	110,173	113,720
NATIONAL HISTORIC SITES				
Adams Mansion	Massachusetts	4.05	(1)	1,614
Atlanta Campaign Markers	Georgia	20.96	(1)	(1)
Federal Hall Memorial	New York	.49	69,662	76,656
Fort Raleigh	North Carolina	16.45	110,785	103,846
Hampton	Maryland	43.30	(6)	(1)
Home of Franklin D. Roosevelt	New York	33.23	486,236	473,724
Hopewell Village	Pennsylvania	848.06	85,801	73,249
Jefferson National Expansion Memorial.	Missouri	82.58	27,801	28,055
Manassas Battlefield Park	Virginia	1,604.57	8,297	9,332
Old Philadelphia Custom House	Pennsylvania	.79	30,985	26,100
Salem Maritime	Massachusetts	8.61	10,522	15,916
Vanderbilt Mansion	New York	211.65	54,004	61,256
Total		2,874.74	884,093	869,748
NATIONAL MEMORIALS				
House Where Lincoln Died	District of Columbia	.05	63,043	55,153
Kill Devil Hill	North Carolina	314.40	54,649	80,784
Lee Mansion	Virginia	2.71	317,991	311,573
Lincoln Memorial	District of Columbia	.61	1,274,967	1,511,390
Lincoln Museum	do	.18	103,609	102,100
Mount Rushmore	South Dakota	1,686.40	341,298	445,174
New Echota Marker	Georgia	.92	(1)	(1)
Thomas Jefferson	District of Columbia	1.20	589,589	560,896
Washington Monument	do	.37	834,693	799,548
Total		2,006.84	3,579,839	3,866,618

See footnotes at end of table.

Areas administered by the National Park Service, acreage and number of visitors, June 30, 1948—Continued

Areas (classification)	State	Federal land (acres)	Approximate visitors, fiscal year July 1, 1946–June 30, 1947	Approximate visitors, fiscal year July 1, 1947–June 30, 1948
NATIONAL CEMETERIES				
Antietam	Maryland	11.36	(8)	(8)
Battleground	District of Columbia	1.03	2,700	2,700
Fort Donelson	Tennessee	15.34	(8)	(8)
Fredericksburg	Virginia	12.00	(8)	(8)
Gettysburg	Pennsylvania	15.55	(8)	(8)
Poplar Grove	Virginia	8.72	(8)	(8)
Shiloh	Tennessee	10.25	(8)	(8)
Stones River	do	20.09	(8)	(8)
Vicksburg	Mississippi	119.76	(8)	(8)
Yorktown	Virginia	2.91	(8)	(8)
Total		217.01	2,700	2,700
NATIONAL PARKWAYS				
Blue Ridge	North Carolina-Virginia.	42,850.08	1,290,716	1,371,481
George Washington Memorial	Virginia-Maryland	2,897.79	(1)	(1)
Natchez Trace	Tennessee-Alabama-Mississippi.	13,648.87	(1)	(1)
Total		59,396.74	1,290,716	1,371,481
NATIONAL CAPITAL PARKS				
National Capital Parks		29,023.42	(1)	(1)
Grand total, National Park System.		20,816,698.83	22,926,675	24,463,653
NATIONAL RECREATIONAL AREAS				
Coulee Dam	Washington	98,500.00	(1)	106,270
Lake Mead	Arizona-Nevada	1,772,533.33	1,225,992	1,576,689
Lake Texoma	Texas-Oklahoma	161,137.00	(1)	1,382,123
Millerton Lake	California	11,605.00	(1)	352,280
Shasta Lake	do	125,230.00	(1)	(1)
Total		2,169,005.33	1,225,992	3,417,362
RECREATIONAL DEMONSTRATION AREAS				
Catoctin	Maryland	9,918.28	(1)	(1)
Custer	South Dakota	5,627.42	(1)	(1)
Total		15,545.70		
NATIONAL HISTORIC SITES NOT FEDERALLY OWNED				
Gloria Dei	Pennsylvania	1.20		
Independence Hall	do			
Jamestown	Virginia			
McLoughlin House	Oregon			
Saint Paul's Church	New York			
San Jose Mission	Texas			
Touro Synagogue	Rhode Island			
Total		1.20		
PROJECTS [9]				
Cape Hatteras National Seashore Recreational Area.	North Carolina	82.10	(1)	(1)
Olympic Coastal Strip and Queets Corridor.	Washington	44,813.84	(1)	(1)
Total		44,895.94		
Grand total, National Park System and other areas and projects under the jurisdiction of National Park Service.		23,046,147.00	22,926,675	27,881,015

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[1] No travel figures available or maintained.
[2] Travel shown from May through June 1948 only.
[3] Travel shown from April through June 1947 only.
[4] Land only. Area encompassed on map included with and made a part of Presidential Proclamation establishing monument is approximately 47,125 acres of land and water.
[5] Closed to public.
[6] Not established.
[7] Travel shown from Aug. 1, 1946, through June 1947.
[8] Included in travel figures of adjacent battlefield sites, military or historical parks, or memorials.
[9] Includes only those in which lands are under National Park Service administration.

Bureau of Indian Affairs

William Zimmerman, Jr., *Acting Commissioner*

IN ONE important respect, the most significant occurrence of the last fiscal year was the preparation and submission to Congress of a long-term program of capital investment for the Navajo and Hopi Reservations.

Apart from the meaning which the proposed investment in resource development must have to a people as poorly situated as are the Navajo and Hopi Indians, the presentation of this program is important because it is the first time that a plan for a specific Indian area has reached the stage of congressional consideration. Other such plans are in the making; indeed, they have been taking shape over a period of years. Acceptance or rejection of the Navajo-Hopi proposal may determine whether our national Indian policy in the future is to be based on a division of the total problem of human adjustment and resource utilization into parcels of a size that can be measured and dealt with on a time schedule.

The idea of such a method of procedure is not proposed now for the first time. The report of the Institute for Government Research, 1928 (the so-called Meriam Survey), urged it for consideration. "The most fundamental step that can be taken," the survey staff reported, is "to advance the economic and social conditions of the Indians" of each jurisdiction, "with due regard to the economic resources of that jurisdiction, and to supply each jurisdiction with a sufficient number of properly trained workers to make that program effective."

Planning in the area of resource development and use has been a major preoccupation of the Bureau of Indian Affairs since the early 1930's. Land losses and heirship divisions resulting from the operations of the allotment law, damages to vegetative cover and to the soil itself resulting from overuse of the land, and the emergency conditions produced by the drought years, all combined to make planning a first requirement of administration.

Planning cannot be effective, however, if it involves people, unless the people can participate in the proceedings. Here was a people, according to the Meriam report, for whom there was no "well considered, broad educational program"; whose health and whose diet alike were "bad"; who were poor, "even extremely poor"; and whose "community activities particularly have often been opposed if not suppressed." To overcome all of these shortcomings and failings was no light undertaking, yet planning for and with the Indian people could never be accomplished until they were in a position to participate and until they had a will to overcome their handicaps.

What here follows is not an exhaustive or even a systematic review of the years since the Meriam report recommendations. It is intended only to suggest some of the problems that were faced, some of the methods that were used to deal with those problems, and some of the accomplishments that resulted.

Getting the Facts

The Navajo-Hopi area programs and the other programs on which work is now going forward draw upon surveys and studies of recent years. The National Resources Board and the President's Great Plains Committee, which functioned in the period 1934–35, gathered basic data on Indian land resources. Technical and administrative personnel within the Bureau cooperated closely with these agencies in compiling the data and in drafting emergency and long-term rehabilitation plans.

Later, in 1936, a cooperative agreement was entered into with the Soil Conservation Service, Department of Agriculture. A survey and planning unit known as Technical Cooperation—Bureau of Indian Affairs (TC-BIA) was created to conduct human dependency and physical resource surveys on Indian reservations and, on the basis of its studies, to prepare plans and programs for erosion control, soil conservation, and proper land use. This unit continued in operation until 1939 and in that time carried out reconnaisance or final surveys on more than 50 reservations. The basic data compiled by this unit as well as the plans outlined have proved invaluable in all later calculations. In connection with the field studies of TC-BIA, a planning and development unit was established in the central office, the purpose of which was to coordinate the field studies with division programs of the headquarters staff.

A further step to obtain plans for every reservation was taken in July 1943, when superintendents and tribal governing officials were instructed to cooperate in the preparation of comprehensive long range plans. This planning was to be based on the analysis of existing data and the resulting programs were to be stated in terms of budget estimates over a period of years. Altogether, 67 such programs were submitted (in some cases more than one reservation was included under one agency, e. g., United Pueblos Agency with 19 separate reserves). These are now on hand and will be the basis of the efforts of the next few years to obtain comprehensive reservation budgetary and legislative authorities.

The present endeavor, announced in instructions to field personnel in April 1948, is to proceed with plans for a limited number of reservations divided into three categories: (*a*) Areas in which the Indians have progressed in the use of their resources and in adapting themselves to competitive society to such a degree as would warrant the withdrawal of the Indian Service in the near future; (*b*) reservations in an intermediate state, and (*c*) reservations in need of major rehabilitation continued over a period of years. In the first group are included the Klamath Reservation, Oregon, and most, if not all, of the Indians in California and Minnesota. The second group includes Pine Ridge, S. Dak.; Standing Rock in North Dakota and South Dakota; and Fort Berthold, N. Dak. Two reservations are included in the third group, Papago, Ariz., and Turtle Mountain, N. Dak.

As an incident to the development of an over-all plan for California, a separate State agency for the Indians of California has been established. This single State agency replaced the Hoopa Valley, Mission and Sacramento agencies.

Resource Use

The basic resource of the Indian people is land. The basic activities from which Indian families must gain their livelihood today are rooted in the use of land.

From a superficial analysis it might appear that Indians are adequately supplied with this basic resource. An estimated 60,000 Indian families own a total of 56,000,000 acres of land (about 40,000,000 acres are tribally held), making an average family holding of 930 acres. If this land were located in a region of even moderate rainfall, such a family holding would probably constitute an adequate economic unit. Unfortunately, more than 13,000,000 acres are located in regions having 10 inches or less of annual rainfall. So sparse is the vegetation in some parts of this area, as on the Papago Reservation, that more than 250 acres are required to provide year long feed for one cow. A larger area, 23,000,000 acres, falls in a range of 10 to 15 inches of annual rainfall, and an additional 8,000,000 acres receive 15 to 20 inches of rainfall. The balance of 12,000,000 acres occurs mostly in the 20- to 30-inch rainbelt, which is the margin at which dry farming can be carried on successfully. Actually, the Indians have only 3,000,000 acres classified as farm-crop land, and of this amount approximately one-half is irrigable.

The problem of increasing Indian use of their resources was complicated in the beginning by lack of equipment, livestock, credit facilities, and agricultural experience. The latter was probably the most serious deficiency since it could not be remedied by the appropriation of funds. The organization of professional extension work in 1930, together with a shift in educational policy which resulted in giving increased training in agriculture and stock raising, has steadily improved this condition.

The first objective of the extension program was to encourage Indians to use their own land and resources instead of leasing to non-Indians, a practice that had grown so widely that on many reservations almost no Indian lands were used by Indians. In the years since 1930, Indians have increased the acreage of crop lands farmed by themselves by 400,000 acres. In addition, they have taken over the operation of more than 7,000,000 acres of grazing land.

Indian-owned livestock, between 1932 and 1947, increased from 171,000 to 361,000—having reached a peak of 382,000 in 1946. Total agricultural income to Indians increased from $1,850,000 in 1932 to almost $49,000,000 in 1947, the latter figure including about $12,000,000 worth of farm products consumed at home. It is conservatively estimated that since the beginning of agricultural extension work on Indian reservations, more than 12,000 families have been completely or partially rehabilitated and are now wholly or nearly self-supporting.

Capital Financing

Lack of an adequate source of credit and the technical advice needed to use such credit as was available had been prime reasons for the poverty reported in the Meriam Survey. Some meager beginnings in supplying credit had been made in 1908 on a few reservations. The first general appropriation to supply credit to Indians was made in 1911 in an amount of $30,000. Annually thereafter similar small amounts were provided for loans, the repayments on which were covered back into the United States Treasury. Under this program and until 1937, Government personnel purchased the items required by the Indians in their farming or other operations, and these were resold to the Indians, allowing the Indian client scant opportunity to decide the kind, type, or quality of the cattle or equipment he was acquiring. Each credit transaction was an individual arrangement between the United States and the borrower. The Indian, whether he repaid his loan promptly or not, could not be assured of continued financing, since the amount available varied from year to year according to the appropriations made by Congress. Of over $7,000,000 which was loaned during this earlier period, generally without planning or real participation by the Indian, approximately $500,000 has been canceled as uncollectable and about $2,000,000 is still owing the Government and probably will not be collected.

In contrast to this record is that made by the revolving credit program authorized by the Indian Reorganization Act of 1934. Congress has appropriated a total of slightly less than $5,500,000 for loans (the total appropriated amounts to $6,600,000, the difference representing accumulative administrative costs over a period of 12 years). Indian tribes have added to this credit pool a total of

$1,800,000 of their own funds. Since the money remains in the fund as repayments are made, the total lending operation exceeds the volume of the original capital fund. In other words, loans totaling more than $16,800,000 had been made as of June 30, 1948, including Federal and tribal money. Most of these loans are made by the United States to the tribal corporation, to credit associations, and cooperative groups; these bodies in turn lend to individuals or tribal enterprises. In this way the tribal corporation or the credit group assumes the immediate responsibility of obtaining repayments—a factor that has completely changed the credit record. On loans from the United States under the revolving credit program, 96.7 percent had been repaid at the end of last fiscal year; 2.26 percent had been extended; .05 percent had been canceled; and .99 percent had been declared delinquent. In relending operations conducted by the tribal groups 95.8 percent had been repaid, 1.9 percent had been extended, .43 percent had been cancelled, and 1.83 percent had been declared delinquent.

Using the Water

Resource development during the years under consideration was further advanced by the construction and expansion of many irrigation systems and water-conservation facilities. Dams and reservoirs built during the years 1932 to 1947 provided additional storage of 250,000 acre-feet. During this period 102,500 acres of Indian lands were placed under irrigation, and this acreage when added to the area previously improved brought the total area supplied with water to 540,000 acres. These acreage totals are exclusive of 290,000 acres of non-Indian land lying within Indian irrigation projects.

Meanwhile, surveys and investigations are under way looking toward the development of all potentially irrigable Indian lands, estimated at an additional 475,000 acres (together with 110,000 acres of non-Indian lands).

The 250 irrigation projects operated by the Indian Bureau represent a total investment of about $58,000,000 (exclusive of funds expended on non-Indian lands included in projects, amounting to about $9,000,000). The projects vary in size from a few acres to areas exceeding 100,000 acres, such as the Flathead project in Montana, Wapato in Washington, and San Carlos in Arizona. Operation and maintenance costs during the fiscal year amounted to approximately $1,600,000, exclusive of power-distribution costs.

The generation and distribution of electric power are carried on at three projects—Flathead, San Carlos, and Colorado River—from which over 100,000,000 kilowatt-hours of energy were developed in 1947. The energy is used for project pumping and for sale to municipalities, industrial users, and over 6,000 private consumers. Two Rural

Electrification districts are operating on energy obtained from the San Carlos project. The success of these power installations indicates clearly that hydro-generating facilities should be utilized wherever feasible on Indian reservations to contribute to the power resources of the Nation and to benefit the Indians through the development of reservation resources. The cost of operation and maintenance of these power systems amounted to $925,000 during the year, all of which was paid for out of current revenues. Construction activities were highlighted by the continuation of the land-development program on the Colorado River Reservation and the resumption of the construction of power-distribution facilities on the Flathead Reservation in Montana to provide service to additional consumers.

Forests and Grass

The management and sale of timber on Indian lands was authorized by the act of June 25, 1910, and the first regulations issued in accordance with this authority directed the conservative use of timber resources. However, except for development work on those reservations where sales were concentrated, such as Menominee, Klamath, Quinaielt, and Flathead, the timbered areas on many reservations remained inaccessible or only partially accessible, for lack of funds, equipment, and technical personnel. The creation of the Civilian Conservation Corps in 1933 and the subsequent allotment of funds to the Indian Service for work on Indian reservations made possible a coordinated program of forest and range management. Truck trails, telephone lines, lookout towers, water facilities, blight eradication, and many other improvements were accomplished before 1942, when the program was discontinued. It is estimated that in that period a total sum of $30,000,000 was invested in permanent installations (exclusive of forest plantations, range reseeding, and similar cultural improvements).

The conservation policy of the Service was further strengthened by section 6 of the Indian Reorganization Act, which directed the Secretary of the Interior "to make rules and regulations for the operation and management of Indian forestry units on the principle of sustained yield management" and "to restrict the number of livestock grazed on Indian range units to the estimated carrying capacity of such ranges."

In recent years Indians have been going into business as loggers, buying Indian-owned standing timber, converting it into logs or other forest products, and selling these products to local sawmills. In a few instances, the Indians own and operate sawmills, and engage in the entire operation of logging, milling, and selling forest products. The Navajo tribal sawmill has been improved during the past decade, and now makes a substantial contribution to the income and welfare of the Navajo Indians.

During the calendar year 1947, approximately 512 million board feet of timber, with a stumpage value in excess of $2,500,000, was cut from Indian lands. Of this amount, nearly 88 million board feet was cut by the Indians for their own use. Cash sales totaled 384 million board feet, for which over $2,000,000 in stumpage payments was received. In addition to the free use and cash sales, 40 million board feet were used by the Menominee, Red Lake, and Navajo tribal sawmills. These three mills sold 36 million board feet of lumber, plus other products, for which approximately $2,262,000 was received. Each of the mills operated at a profit during the year.

Indian range lands, particularly in the Southwest, still suffer from the effects of overgrazing and deficiency in precipitation. Progress has been made even there, however, through reduction in number of livestock grazed, improvement in the quality of the livestock, and the development of range improvements and facilities.

During the calendar year, 44 million acres of Indian range lands were grazed. Of this area 34,500,000 acres were used by Indians and 9,500,000 acres by non-Indians, providing a total of more than 9 million cow-months of grazing. The cash income paid by non-Indians for grazing privileges exceeded $1,500,000.

For many years appropriations for the management of Indian forest and range resources have been inadequate to provide for minimum management standards. The value of Indian forest and range resources to the Nation fully warrants a substantial increase in funds.

Mineral Exploitation

With minor exceptions, and because Indians have lacked experience and the heavy capital requirements, the production of minerals on Indian reservations has been accomplished by private enterprise, pursuant to the terms of leases granted by the Indian owners with the approval of the Secretary of the Interior or his authorized representative. The leases in general follow the pattern of the usual commercial leases, with perhaps stricter emphasis on orderly development and operation within conservation principles, proper abandonment of depleted wells and mines, and audited accounts of the royalties and rentals due the Indians.

Leasing practices have changed with the requirements of the times. During the early 1930's overproduction of oil and gas and low prices justified a policy of discouraging leasing. With the coming of world emergency there was rapid change to a policy of all-out enlistment of Indian mineral resources for national defense and the winning of the war. Since the end of the war critical shortages of petroleum and other minerals have resulted in intensified exploration activities and the development of new techniques for producing additional oil from stripper-well areas and for producing minerals from submarginal ores. In support of this latter policy the Indian Service has liberalized the acreage limitations on holdings of oil and gas leases on Indian reservations; it has also delegated authority to the superintendents of several jurisdictions to approve oil and gas-mining leases and related instruments; cooperated with the Oklahoma State Corporation Commission in bringing Indian lands within drilling units and unit operation plans approved under the conservation laws of the State; and approved geological and geophysical prospecting permits to large areas of Indian lands.

The following data show the extent of Indian mineral leasing and producing activities: Area under oil and gas leases, 1,037,601 acres; number of oil and gas leases in force, 7,732; oil and gas wells, 11,302; acreage under lease for minerals other than oil and gas, approximately 52,000 acres; total mining leases and permits other than oil and gas, 273; total petroleum production for 10-year period (ending 1945) 251,000,000 barrels of oil with associated gas. The income during the year to individual Indians and Indian tribes from mineral leasing and production, including bonuses, rentals, and production royalties, amounted to approximately $12,000,000.

Negotiations with the Choctaw and Chickasaw Nations of Oklahoma for purchase by the United States of the segregated coal and asphalt lands, comprising 370,000 acres of coal deposits, 2,800 acres of asphalt deposits, and 11,000 acres of nonmineral lands, were completed with the execution of a contract on October 8, 1947, at a purchase price of $8,500,000. The contract was ratified by a majority of the enrolled members of the two tribes in a referendum held in November 1947, and by Congress in Public Law 754, approved June 24, 1948. Appropriation of the purchase price and execution of the tribal deeds of conveyance will complete the acquisition of this valuable property and terminate a trusteeship of many years.

Making Craft Work Profitable

The Meriam report directed public attention for the first time to the economic value of Indian handicrafts. This report led to the establishment in 1934 of a committee to survey and report to the Secretary of the Interior on the potential economic importance of Indian arts and crafts. As a result of the report of this committee and upon recommendation of the Secretary, the Congress enacted legislation which was approved August 27, 1935, creating an Indian Arts and Crafts Board. This Board was given the duty of promoting the economic welfare of the American Indians through development of Indian arts and crafts and the expansion of markets for products of Indian craftsmanship.

The Board since its inception has worked to increase the output of Indian crafts, to elevate their quality, to protect genuine Indian crafts from unfair competition of mislabeled factory-made imitations, and to bring the arts and crafts of the Indian before the public.

During the past year the Board has undertaken to rehabilitate and reestablish producing groups which practically ceased to operate during the war years. Many of these groups lost their markets because of their inability to supply the demand for crafts. In other groups key craftsmen have not resumed their work since returning from the armed services or from war jobs. Many have gone into other types of work, and the training of new workers was completely neglected.

The program will also benefit from the appointment of Mr. Joseph C. McCaskill as general manager, a position which has been vacant for several years.

The opening of the new Museum of the Southern Plains and Craft Shop at Anadarko, Okla. (August 17, 1948), will provide an outlet for the crafts of western Oklahoma.

Crafts furnish a significant supplemental income to thousands of Indians. Although machine-made products are increasingly competing with Indian handicrafts, there is still a flourishing demand by buyers who want handmade articles of Indian form and design.

Conserving Wealth

The abuse and mismanagement of lands which grew out of the mistaken belief that the rich land resources of this country were inexhaustible was particularly apparent in the early use of Indian lands, since these were used largely by white lessees on an insecure tenure. Indian lands often were characterized by the worst abuse and destruction of any lands in the regions in which they lay. Recognizing this condition, the Indian Service took an active part in the formation of the soil erosion service in 1935. The first demonstration area established by the new agency was on the Navajo Reservation. Not until the beginning of the fiscal year 1941, however, was the Bureau of Indian Affairs given responsibility and separate funds for the conservation of soil and moisture resources on Indian lands. In the brief years since then the results achieved in the field of cooperator agreements have been more than gratifying.

Indian tribal councils, individual landowners, and lessees of Indian lands have contributed increasing amounts of money, labor and materials in conservation work. In 1941 the proprietors or users of Indian lands only barely matched Government expenditures; by

1948 the contributions from the landowners and users amounted to $3 for each dollar expended by the Government.

More recently there has been a shift in the program from emphasis on stopping land depletion to emphasis on soil improvement, weed control, the planting of cover crops, green manuring, improved plowing techniques, the use of commercial fertilizer, strip cropping, and similar devices. On the Nez Perce and Coeur d'Alene Reservations in Idaho it is estimated that 12 to 15 bushels per acre have been added to the wheat yield on Indian lands and this increased yield at current prices was worth $595,000 in additional income last year. This is the more remarkable in that the lands in question have been planted to wheat regularly for almost 50 years and in that period it is estimated that over 40 percent of the top soil had been lost.

On several reservations where 5 years ago it could be said with some justification that Indians who leased their lands had no interest in them, the Indians today are taking a very active part in seeing that their lessees carry out the provisions of farm use plans. Soil conservationists in collaboration with reservation superintendents and Indian representatives, formulate these land-use stipulations. These stipulations cover the worst land-use abuses, such as continuous cropping on the same field to a cultivated crop and burning straw. Stipulations are concisely stated so they cannot be misunderstood. Only those are included the violations of which can be readily recognized, reported, recorded, and made clear to the land user. Stipulations are not made more severe than the majority of land users will accept, but it has been found that stipulations can be materially strengthened and additional ones included each year. These stipulations are written into lease and loan contracts. Their enforceability has already resulted in a complete change in farming and cultivation practice on all Indian lands in a few communities.

After 4 years of cautiously incorporating enforceable stipulations in leases, 625 leases included a comprehensive list of stipulations in 1947; by 1948 this number had increased to 4,496. Less than 3 percent of land operators failed to comply fully with every provision of the stipulations, and Indian operators have complied as readily as white operators on Indian lands.

Indian lands above such reservoirs as Mead Lake, Texhoma Lake, Elephant Butte, and Roosevelt, by contributing great loads of sediment behind these structures, are reducing their storage capacity. The Indian Bureau and the Indians have been very conscious of this problem and within limitations of available funds have made valuable contributions toward its solution, particularly in the development of techniques. The Navajo and Hopi Reservations contain 14 percent of the Colorado River drainage basin above Hoover Dam, but contribute over 20 percent of the sediment and only about 2 percent of the water to Mead Lake. The application of economical corrective measures since 1941 paid real dividends late in 1947, when torrential rains occurred. Subsequent investigation revealed that 30,000 acre-feet of sediment en route to Lake Mead was put to beneficial use by being diverted and spread over 256,000 acres of range land. This sediment would have decreased storage space in Mead Reservoir by a volume of water sufficient to irrigate 6,000 acres of farm land in central Arizona or Imperial Valley.

The Indian Bureau since the early 1930's has materially improved the vegetative cover on ranges of the above reservations and proportionately reduced sheet erosion, but 75 to 85 percent of the sediment moved into reservoirs results from gullying, bank cutting, and bed cutting. Range improvement is relatively ineffective in stopping this source of sediment, and structural means must be employed.

If erosion were to stop until lands could be adequately treated, it would take about 40 years at the present rate of accomplishment to repair present damage. But erosion does not wait on appropriations, and corrective work is not keeping pace with destruction. Due to erosion, an average of 48 acres of Indian farm land out of the total of 3,260,000 acres is becoming unfit for further production of crops each day. Losses on the 53,000,000 acres in other use are also very severe. A more vigorous attack on the problem must be provided to stop unnecessary permanent and irreparable loss of productive lands and sedimentation of limited reservoir sites. The rate of applying curative measures ought to be doubled, in order to reach the entire area in a period of 20 years.

Land Losses

Having in mind this Indian record of increasing use of the land and its resources, it is disheartening to report that the demand for fee patents and for the removal of restrictions against alienation has been greater during the past year than at any time in the past 15 years.

The present policy with respect to Indian-owned lands originated in the 1920's, following a brief period of forcing fee patents upon Indians, even when Indians expressed objection. The results of forced patenting were disastrous, in terms of land losses and subsequent impoverishment. This fact was pointed out in the Meriam Report, which found that "a relatively small proportion of the Indians who have been declared competent to manage their own affairs have retained possession of their property."

The promulgation by Secretary Ickes of Order No. 420 on August 14, 1933, stopped the sale of Indian allotments and heirship lands, except in cases of emergency. Later, by the adoption of the Indian Reorganization Act (act of June 18, 1934), Congress declared that no lands remaining in tribal ownership should be individually allotted, but the prohibition applied only to those reservations which voted to accept application of the act.

The 1934 act also authorized a land-acquisition program, through appropriation of funds and through the return to Indian ownership of certain ceded lands. Under this authority plans were formulated for the acquisition of lands for tribes, bands, and groups of Indians whose land base had been badly shattered or for whom no land had ever been provided. Plans were also formulated for consolidating scattered tracts of Indian-owned land through purchase, relinquishment, and other arrangements by which key tracts were obtained and blocked out to form economic units. Land was acquired under various authorities and appropriations, as follows:

	Acres
Indian Reorganization Act funds	395, 500
Miscellaneous (gratuity appropriations, cancellation of reimburseable debts, etc.)	334, 000
Tribal funds	390, 000
Restoration of ceded lands (sec. 3, Indian Reorganization Act)	965,000
Special legislation (transferring public domain)	1, 063, 000
Uintah and Ouray legislation	510, 000
Puertocito purchase (Navajo)	31, 663
Total	3, 689, 163

As was reported last year, the rising demand for land and the high prices being paid have tempted many Indians to seek buyers for their land, and many white men have been as strongly urged to seek Indian land. Under existing law the Secretary of the Interior may issue fee patents or remove restrictions against sales, if he finds that such action by him is in the Indian interest. In response to the increasing demand, the Indian Service has attempted conscientiously to discover in each case if the granting of a fee patent would benefit the applicant and if the sale of a given tract could be allowed without destroying the efforts of others to consolidate their holdings into economic units. These efforts to comply with the requests of allottees for fee patents while safeguarding other Indian interests are brought to nothing at times by the enactment of legislation requiring the Secretary to issue fee patents. When such legislation is adopted without regard to the total problem of land needs at a given Indian reservation, every advance made in the last 15 years is threatened.

Some isolated Indian holdings can be sold, without endangering the economy of an entire community. Where this possibility exists, fee patents are being issued or restrictions against sale are being removed. However, unless the Nation is prepared to pauperize the Indian people, discretion must continue to be exercised in issuing patents-in-fee, and that discretion to be effective must be lodged in a responsible official.

More fee patents were issued during the last fiscal year than in any one year since 1933. The total of 423 patents included 23 which the Secretary of the Interior was directed to issue in private bills adopted by Congress. The area covered by these patents amounted to 67,000 acres. In addition orders removing restrictions were issued covering an additional 35,000 acres, and this latter total is exclusive of the lands on which restrictions were removed by operation of present laws in the Five Tribes area of Oklahoma.

The rate at which patents are being issued is evidently accelerating. Thus, in the first 6 months of 1947, patents covering 26,000 acres were allowed, while in the first 4 months of 1948 a total area of 36,000 acres was involved.

Educating for Better Living

Basic to the program of resource development and tribal management has been a general advance in educational methods, facilities, and accomplishments.

The importance of the educational program is perhaps accurately reflected in the 30 or more references to education which are found in the Meriam survey. The general point of view of that survey is suggested in the following statements:

> The Indian educational program cannot simply take over the traditional type of school; it must set up its own objectives, finding out in general and for each reservation or tribal group the things that need to be done.
>
> A genuine educational program will have to comprise the adults of the community as well as the children * * * must include teaching how to farm; it must include a thorough campaign to eliminate illiteracy; it must teach interdependence and reliance upon their own efforts to a people who have been largely miseducated in this direction for several generations.
>
> The heavy "over-ageness" among present Indian school children reflects the failure * * * to get children into school.
>
> Properly equipped personnel is the most urgent need in the Indian education service.

On each of these essential criteria, and others which could as well be included, positive gains have been recorded.

The schools of the Indian Service are based on standard educational practices, in that the courses of study are equivalent to or are superior to the courses of study in the States in which the Indian schools are located. While there is this basic conformity, the schools have also been adapted to the needs of each reservation or each area, accordingly as the area is primarily devoted to farming, to grazing operations, or to survival on the Arctic coast.

The common core of minimum essentials is present in all cases, but modifications are found in the activities and social and economic experience suited to the reservation or community conditions. In shaping its curriculum objectives, the Indian Service has obtained the services of experts in and out of the Federal Government.

The Indian Service has developed a community school, on both a day and boarding basis, which has become the heart of the community. Essentially, it teaches children, provides the main meal of the day for many children, keeps a constant check on their health, makes it possible for the parents to provide adequate clothing on a work-payment basis, provides many types of recreational training, and makes the most of every occasion to obtain functional experiences in connection with the learning process. In addition, it serves as a center for adult community life; its shops and home economics rooms become work centers for fathers and mothers in the repairing of furniture and farm equipment, in the making of clothing, the canning of foods, and in countless other ways. Both entertainment and instruction are provided through school movies, discussion groups, lending libraries, and night classes.

The situation with regard to "over-ageness" of Indian children in school has improved greatly since 1928. In that year, the first in which there are comparable data on school retardation, only 19 percent of all children in Indian schools were at the proper grade for their chronological age or were not more than 1 year retarded. In 1946, the latest year for which estimates are available, 62 percent were at their proper grade or not more than 1 year retarded. These are the conclusions of Dr. Shailer Peterson of the University of Chicago, who has just completed a service-wide testing program on Indian children. Other conclusions reported by Dr. Peterson are indicative of advances made in teaching effectiveness: (*a*) Children in the elementary grades are making better academic progress than the children now enrolled in high school—eighth-grade children appear to have a better command of English than twelfth-graders; (*b*) today's fourth-grade children in Indian schools more closely approximate the advancement of rural white children than is true of Indian children in the upper grades—a remarkable fact, considering that many Indian children enter school speaking only their native tongue.

While these improvements are encouraging, it is even more important that it is now possible to supply Indian children with greater facilities at the top grade levels. At the time the Meriam survey was made, only 12 Indian Service schools were offering high-school courses and they were located away from the reservations. None of these schools was accredited. Many of these nonreservation schools have been closed since that time, while those that remained were improved in teaching standards so as to meet State requirements. Since then 26 reservation high schools have been added. A total of 27 accredited Indian Service 4-year high schools are operating in 1948. In 12 other schools 10 grades are offered and these may eventually assume the last 2 grades.

Entrance requirements for teachers and supervisors have been greatly strengthened since the Meriam survey. Normal-school graduates with 2 and 3 years of training continued to be accepted until about 1938. Working with the Civil Service Commission, the Indian Service succeeded in raising the standards so as to require that all teachers have a 4-year bachelor's degree with 18 credit hours of professional courses in education. All Indian Service high schools are now staffed with college-trained teachers, as are also a majority of the elementary schools. Teachers' salaries have been increased, and before the war the average exceeded the salaries paid teachers in most rural public schools. Since the war, with rising costs and the increase that has been granted in most State systems, Indian Service teacher salaries have again fallen below State averages. By allowing their leave to accumulate, teachers may obtain 60 days of educational leave every alternate year; in addition, the Indian Service has sponsored summer schools each year since 1936, with the exception of two war years, and these have been devoted to enriching teacher understanding of educational methods and of Indian backgrounds.

Any lingering doubt as to the native ability of the Indian people will be dissipated by the findings now being published as a result of the intelligence tests made of Indian children, in some cases in comparison with non-Indian children, in connection with the Indian education research program referred to in previous annual reports. Recognizing the language difficulty which distorted the results of many previous efforts at measuring intelligence, the Grace Arthur Point Performance Scale and the Goodenough "Draw-A-Man" tests were used with Hopi, Navajo, Sioux, Papago, and Zuni Indian children. The same tests were used with white school children to furnish comparable scores.

The highest average IQ's of children, ages 6 through 11, were made by Hopi children of Arizona. One group of Hopi children had an average IQ of 112 and a second group had 111, both on the Arthur Scale. These two groups measured 111 and 117 on the Goodenough test. White children scored an average IQ of 103 on the Arthur test and 101 on the Goodenough. Pine Ridge Sioux children had a range of from 101 on the Arthur to 114 on the Goodenough. The Zuni children ranged from 100 to 112 on the two tests. Papago children ranged from 100 to 109. Navajo children ranged from 84 to 110. Every Indian group had a higher average on the Goodenough test than the white children.

Current Program

During 1948, the failure of Congress to appropriate the funds needed to meet the increased cost in commodities and the increased enrollment which followed the termination of the war, resulted in the elimination of 2,143 children from Federal boarding and day schools in the United States and in the closing of 18 day schools in Alaska serving 600 children. In the case of 11 of these Alaska schools, the communities were served by Territorial public schools which were able to absorb about 450 of the children. The remaining 7 day schools constituted the only educational opportunity open to the children of these villages, for whom education has now ceased.

The consolidation of the education loan program with industrial loans and the transfer of the lending authority to tribal loan committees greatly increased Indian participation in the program, but in the absence of any increase in the appropriation for loans, many tribes were confronted with the choice between making educational loans or industrial and agricultural loans. The transfer to the tribes also necessitated the imposition of an interest charge on educational loans to cover the tribal expenses in handling the program, whereas heretofore educational loans had been noninterest bearing.

State contracts covering Federal assistance to public schools in the education of Indian children have been negotiated with Oklahoma, Wisconsin, Montana, and North Dakota during the year. This is in addition to State contracts already in force with California, Washington, Minnesota, Arizona, Oregon, and Nevada. Federal funds may not be used to reduce the amount of State school support, but are used to assist these local districts whose tax revenues are inadequate. The State funds for educational purposes furnish from 4 to 5 percent to as much as 60 percent of the total cost of education. The need for Federal funds to assist the local districts which enroll Indians is therefore equally variable.

The increased State concern with the problem of Indian education which has resulted from the negotiation of these contracts has been of great advantage to the Indian people. Reduction in education funds has necessitated the elimination of the position of education field agent at many jurisdictions. These are the Indian Service men who have encouraged Indian attendance at public schools and who have advised public school teachers and supervisors of specific Indian needs to the end that the public school program might be more effective. Although the loss of these employees has been reflected temporarily in lower public school attendance, the responsibility for maintaining Indian attendance in available public schools properly rests on the State and local officials.

During 1948 a total of 1,335 Navajo students was enrolled in off-reservation boarding schools. For the most part, the children were non-English speaking and over 12 years of age. A special program has been developed which is designed to give a useful command of

English, a basic elementary education and vocational skills within a 5-year period. Careful tests of academic achievement and of English mastery are being given at intervals. On-the-job employment training opportunities are being arranged for these children in the communities adjacent to these nonreservation schools, and every effort will be made to find them permanent placement away from the reservation. Sherman Institute, Carson, Phoenix, Albuquerque, and Chilocco Indian Schools and the Riverside and Fort Sill Reservation boarding schools in Oklahoma have participated in this program.

Basic Health Improvement

A start had been made even before the Meriam survey to improve health conditions by organizing a separate Indian medical service in 1924. At the request of the Secretary of the Interior, the United States Public Health Service detailed one of its surgeons to the Bureau of Indian Affairs in 1926 to serve as chief medical director supervising all medical, dental, hospital, and sanatorium activities. Later the Public Health Service supplied physicians to serve as district directors in the field. These actions by themselves could not result in the development of an adequate medical service so long as limitations on staff, equipment, and funds prevailed. Improvement with respect to these details came in succeeding years as new hospitals were built, as a better trained and more diversified staff was recruited, and as up-to-date equipment was added to the hospital plants. Appropriations for Indian health service increased from $948,000 in 1928 to $2,677,800 in 1933, and to $8,653,300 in 1948.

In that same period a total of 46 new hospitals were constructed in the United States and 5 were constructed in Alaska. These hospitals provided 1,921 additional beds for general medical and surgical uses and 682 beds for tuberculosis cases. For the most part these buildings replaced old and usually obsolete structures, but in some cases the hospitals were built where none had been before.

New hospital facilities have recently been transferred to the Indian Service and new construction has been authorized, as follows: A temporary hospital of 150-bed capacity was secured from the War Department at Sitka, Alaska, and has been converted into a tuberculosis sanatorium; a 70-bed general hospital, also at Sitka, was obtained from the Navy, and at present a 200-bed tuberculosis wing is under construction at the same location; an appropriation was obtained in the Eightieth Congress for the construction of a 400-bed hospital at Anchorage, Alaska, providing 300 beds for tuberculosis cases and 100 general medical and surgical beds; and, in addition, Congress authorized construction in the present fiscal year of four temporary isolation units, each having 20 beds, for the care of advanced cases of tuberculosis, to be attached to existing hospitals in Alaska.

While the number of physicians has remained fairly constant through these years, the activities of the medical field staff have changed, as emphasis in the medical program has shifted from curative to preventive health measures. Here a considerable increase in the number of nurses on duty, from 298 in 1934 to 513 in the present year, is a further reflection of the increased emphasis on public health work.

The real index to the effectiveness of this health program is reflected in declining mortality rates. Indian deaths in 1928 occurred at the rate of 21.8 per thousand of population, while in 1945, the latest year for which figures are available, the rate was 12.04 per thousand of population. The Indian birth rate has declined only slightly in the same interval, from 28 to 26.8 per thousand of population.

The Indian Service operated 74 hospitals in the United States and Alaska in 1947, with a total of 4,009 beds for the treatment of Indians, Eskimos, and Aleuts. Eight of these hospitals previously showing low attendance were placed on a "limited service" basis during the year with available services consisting of out-patient activities. The 34-bed general hospital at San Jacinto, Calif., was closed and removed from the official list of hospitals.

During the year 51,687 patients, excluding newborns, were admitted for in-patient treatment, and 102,656 individuals received out-patient treatment in these hospitals. The daily average attendance in the hospitals, again excluding newborns, was 2,397. There was a total of 4,883 newborn admissions. Out-patient service was furnished to 107,744 individuals in field dispensaries, clinics, and homes.

Field health services consisting mainly of communicable disease control, school health activities, trachoma control and public health nursing were continued in approximately 60 locations in the States, and 20 in Alaska.

Tuberculosis continues to be the major health problem of the Indian people. Considerable case-finding work with two mobile X-ray units was continued. A third unit has been purchased for exclusive use on the Navajo Reservation where tuberculosis is highly prevalent. The death rate from tuberculosis among Oklahoma tribes where the control program has been vigorously applied has been steadily declining within recent years. The mortality rate for 1946 was reported to be less than 100 per 100,000, whereas the over-all rate for all tribes is over 200 in the States and over 600 in Alaska.

Two hundred and eighty-seven student nurses of the United States Cadet Nurse Corps received their 6-month senior cadet experience in 11 hospitals of the Bureau of Indian Affairs during the year. Twenty-five young Indian women graduated from the Nurse Aid School of the Kiowa Hospital, Lawton, Oklahoma, in June 1948.

Organizing Community Life

The efforts to develop forms of local self-government and to release the Indian person from oppressive laws and regulations have been fully as notable as the work in resource development. The Meriam survey had reported a "striking lack of development of community life for useful ends," and so long as such a condition existed no other program of assistance could hope to succeed.

Two significant steps were taken at the outset. One was the Pueblo Relief Act of May 31, 1933, prohibiting the Secretary of the Interior from spending the funds of the New Mexico Pueblos "without first obtaining the approval of the governing authorities of the Pueblo affected." This limitation on the Secretary's discretion was made general in the Indian Reorganization Act of 1934. In that act, all tribes adopting written constitutions were empowered to veto any proposed disposition of tribal assets by a Government official. The second initial step was the act of May 21, 1934, repealing 12 sections of the United States Code. These laws, some of which dated back to 1800, hampered freedom of speech, empowered the Commissioner of Indian Affairs to remove from an Indian reservation any person deemed "detrimental," and sanctioned military control within reservation boundaries.

Various provisions of the Indian Reorganization Act were the source of new powers and responsibilities for the Indian tribes.

The inherent powers of Indian tribes were specifically recognized in the sections dealing with tribal organization and incorporation. A Solicitor's opinion, issued in 1934, defined these powers as, among others, the right to determine tribal membership, to regulate domestic relations, to control descent and distribution of property, to levy taxes, and to administer justice. An entirely new land policy was ordered: No Indian reservation might thereafter be allotted in severalty; existing periods of trust were automatically extended and were to continue until otherwise directed by Congress; the Secretary was authorized to restore to tribal ownership any lands previously opened for sale or other disposition, where such lands remained unoccupied; no Indian trust lands might be sold except to the tribe to which the allottee belonged; and the Secretary was authorized to acquire new lands for Indian use, for which purpose a sum of $2,000,000 in annual appropriations was authorized.

The Indian tribes had a choice whether they would accept or reject the Indian Reorganization Act in elections called by the Secretary of the Interior. Altogether, 258 tribal elections were held, in which 181 tribes adopted the law and 77 tribes rejected it. Subsequently, 93 tribes adopted written constitutions and 73 of these took the additional step of applying for and receiving a charter of incorporation. These charters usually provide that after a term of years, 10 years in most cases, the tribe may, by a further referendum, terminate the right of the Secretary to supervise the leasing of tribal lands, the making of timber sale, mineral and other types of land-use contracts, the making of loans, the pledging of income, and related matters of a business nature.

The policy of encouraging the use of Indian resources by Indians and transferring management responsibility to tribes and to individuals has been carried out in other ways. Heretofore, the leasing of tribal and allotted lands has been conducted by the Government at its own expense. The Indian land owners bore neither the cost of such administration nor shared any responsibility for it. During the past year, leasing enterprises have been established by a number of tribes and at the present time these tribes are employing a total of 75 employees, invariably members of the tribes. The costs of administration are entirely met by the operation of the enterprise and most of the tribes are actually realizing a slight profit.

Revised regulations were issued last year permitting an individual Indian land owner to lease his own land and that of his minor children and to collect the lease rentals directly from his client. The reservation superintendents have also been instructed to release individual Indian money accounts where the balances amount to less than $100 and, in their discretion, they may close out all balances below $500.

In January 1946, in a further effort to release Indians from supervision, reservation superintendents were authorized to issue clear and unrestricted title to chattel goods where these had previously been held in trust by the United States. Thus, Indian borrowers from the revolving credit fund previously were not able to get clear title for resale purposes to cattle or other property purchased with loan funds, when the loan had been paid in full, without first obtaining a permit for each animal or piece of property involved. Borrowers are now encouraged to take title in their own names and when the loan is paid off they automatically obtain the property clear of any trust restrictions.

The Future Task

By these various changes of law and regulation, revisions of policy, adaptations of method, Indian administration has moved ahead during these years, through resource development and financial assistance, through education, through improved health, and through the development of community organization, toward the final objective of bringing Indians into fuller possession and use of their resources and the adaptation of their cultures to the life in modern America.

The total task of human adjustment and resource utilization cannot be attacked as a mass problem. It is too unwieldy and too many coordinate elements of time and materials are involved when the problem is approached in its entire mass. Now that certain ground work has been accomplished, such as has been outlined here, Indian administration must for the future concentrate its efforts on particularizing the problem faced by each tribe or region occupied by a group of tribes, in terms of climate, economic opportunity, assimilation with surrounding white neighbors, and related factors.

One grave fact that has emerged from the closer study of Indian reservations, is the great disparity that exists between Indian population and available economic opportunity. On a number of reservations, most notably the Navajo, Hopi, and Papago, even if maximum development of resources were possible many thousands of Indians would still be left without any means of livelihood. For these, there can be no future within familiar reservation boundaries. They and their children must be trained and placed in outside employment and doubtless they will need initial assistance in adapting themselves to non-Indian communities.

Physical Plant

The construction work carried on at practically every Indian Service school and agency since the beginning of the first Public Works program in 1933 has provided employment for a large number of Indians and at the same time has resulted in much needed improvements in housing, hospitals, schools, and other facilities.

In the construction of buildings on Indian reservations during the period 1933 to 1939, approximately 80 percent of the funds spent for labor went to Indians, who earned an estimated $9,600,000 during those years.

There are approximately 15,000 buildings in the Indian field service, exclusive of Alaska, used by administration, education, health, and other program activities. These buildings, together with the various utility installations, have a current estimated valuation in excess of $100,000,000 with a replacement cost at present-day prices of about $200,000,000.

Since Pearl Harbor, funds and manpower as well as available materials have been insufficient to maintain these facilities in a good state of repair. As a result, there is an urgent necessity for a large maintenance and construction program to provide adequate and modern facilities and to protect this large investment of the Government by adequate maintenance.

Construction work accomplished during the past year included improvements to facilities and the building of new schools, dormitories, low-cost housing, and quarters for employees. At the close of the fiscal year, 43 projects with a value of $4,362,600 were under construction. Seven projects with a value of $170,000 were in the planning stage.

The year also marked the beginning of a medical construction program for Alaska. The largest single item of construction was the Mt. Edgecumbe Sanatorium, at Sitka, at a total cost of $2,412,400.

Roads

In many sections of the Indian country in 1933, Indians were using pack animals and even their own backs to bring supplies into their communities. Roads were nonexistent; streams were forded; wagon trails washed out after every heavy rain. Indians could not readily get their products to market if they had products; worse, their children could not get to school in periods of bad weather. Authorization for road work on Indian reservations was provided in the act of May 26, 1928, but it was not until the fiscal year 1934 that sufficient funds were made available to organize a Service-wide program of road construction. During a 15-year period up to 1948, Congress has appropriated more than $37,000,000 for new roads, $23,000,000 in improvements to roads and bridges, and $14,000,000 in maintenance operations. The Service today operates almost 8,000 miles of graded and drained roads, of which 3,300 miles are gravel surfaced and about 200 miles are paved. This still leaves certain sections of the Indian country, as on the Navajo Reservation, poorly provided with communication facilities.

During the fiscal year 1948, the Service completed construction and betterment on 247.2 miles of forest roads giving access to standing timber. This work was financed by the National Housing Administration, and was for the purpose of increasing lumber production. These roads will remain as protection roads for valuable timber resources.

The first substantial road and bridge construction program since 1941 was carried out. A total sum of $4,669,589 was available for this purpose, and in addition a considerable quantity of surplus equipment was obtained. Maintenance work was stepped up and progress was made in repairing the deterioration which accumulated during the war years.

Great improvements have been made in work methods. As Indian operators were trained and modern road-building equipment acquired, pick and shovel, wheelbarrow, horse fresno, and dump wagon methods have given way to standard road-building practices. Greater efficiency and lower unit costs resulted and made it possible to build roads and bridges to better engineering and safety standards.

The road program is designed to assist the Indians in various ways. A large number of Indians have learned the skills of road building and have established careers as machine operators, foremen, draftsmen, surveyors, accountants, mechanics, and civil engineers. Many of these have left the reservations and are employed by contractors and engineering organizations. The building of roads has destroyed isolation and has made rural reservation life more enjoyable, at the same time multiplying the contacts between Indians and their white neighbors.

The Legal Record

Favorable court decisions in Arizona and New Mexico opened the door to full voting privileges for the approximately 100,000 Indians in those two States. These decisions removed the last legal barriers which were interposed between the Indians and their franchise rights. Although all Indians born within the United States were made citizens by the act of June 2, 1924, seven States, as recently as 1940, barred Indians from voting either by discriminatory State laws or by interpretations of State law resulting in discrimination. Five of these States had allowed their restrictive franchise provisions to go unenforced and the Indian citizens of those States were permitted to vote. Now that formal decisions have been handed down in Arizona and New Mexico, it seems unlikely that any of the States in which discriminatory laws remain on the books will attempt in the future to enforce them against their Indian citizens.

In another civil rights case, *Pearce* v. *Crocker*, legal assistance was rendered to the attorney of an American Indian in a restrictive covenant case. The issue in this instance was not brought to trial since another restrictive covenant case, *Hurd* v. *Hodge*, was before the United States Supreme Court. A decision denying access to the Federal courts as a method of enforcing restrictive covenants was tantamount to a favorable decision in behalf of the Indian involved in *Pearce* v. *Crocker*.

A case of critical importance to the natives of Alaska was argued in the Ninth Circuit Court, *Grimes* v. *Hynes*, which upheld the validity of the upland portion of the Karluk Indian Reservation, established by the Secretary of the Interior in accordance with the act of May 1, 1936. The court declared invalid the inclusion of 3,000 feet of coastal water. This case will be argued in the United States Supreme Court during the fall term.

Further affirmation of the rights of Indian tribes to fish at their usual and accustomed fishing places on the Columbia River was provided in the decision in *United States* v. *Cramer et al.*, in which non-

Indians were enjoined from interfering with members of the Nez Perce and Yakima Tribes while occupying fishing grounds on the Columbia.

Since the creation of the Indian Claims Commission in accordance with the act of August 13, 1946 (60 Stat., 1049), there has been great activity on the part of Indian tribes and their attorneys to file petitions. Such filings must be accomplished within 5 years from the passage of the act or the claims will be disbarred forever after. Approximately 100 Indian tribes or bands have employed attorneys under approved contracts and some 32 claims have been filed with the Indian Claims Commission.

Missouri River Basin

The Missouri River Basin Investigations Staff of the Bureau of Indian Affairs accelerated its program during the fiscal year. Problems of adequate staffing have continued to hamper the work but by now the major lines of interest are covered. Active surveys and study programs were conducted in connection with nine projects sponsored by the Bureau of Reclamation, three projects of the Corps of Engineers, and four projects of the Bureau of Indian Affairs. More intensive investigations were centered on the Boysen and Grand River units of the Bureau of Reclamation and the Garrison and Fort Randall projects of the Corps of Engineers.

Congress adjourned without formally approving the proposed contract between the United States and the Fort Berthold Indians for the taking of their lands in the Garrison project. In the course of the year the Indians abandoned their effort to halt construction of the project and a contract was negotiated between the Tribal Business Council and the Corps of Engineers, within the provisions of the Civil Functions Appropriation Act of 1948. This act authorized the payment of $5,105,625 as compensation for the taking of lands and for the cost of removing the Indians' homes. The contract subsequently secured the written approval of two-thirds of the adult members of the tribes and of the Tribal Business Council and was concurred in by the Secretary of the Interior on May 20, 1948. It then went to Congress for ratification and was still pending at the time of adjournment.

Commissioner Brophy Retires

Before the close of the fiscal year William A. Brophy retired as Commissioner of Indian Affairs. He had assumed that post on March 15, 1945, and served until June 3, 1948. Prior to his appointment as Commissioner, Mr. Brophy had been special attorney for the Pueblo Indians in Albuquerque, N. Mex., and, after 1943, had been chief of the Puerto Rico section in the Division of Territories, Department of the Interior. He has resumed the practice of law in Albuquerque and his former position as attorney for the Pueblo Indians.

Office of the Solicitor

MASTIN G. WHITE, *Solicitor*

ADMINISTRATIVE CHANGES.—As a result of the reduction-in-force program which was mentioned in the annual report for the fiscal year 1947 and which took place during the latter part of that year, the personnel strength of the Office of the Solicitor for the fiscal year 1948 consisted of 19 attorneys and 24 other employees, as compared with a personnel strength of 30 attorneys and 38 other employees for the fiscal year 1947. Because of the inability of the depleted staff to handle the whole volume of work coming into the office during the fiscal year 1948, it was necessary to utilize the available personnel in such a way as to handle as much of the incoming work as possible, concentrating upon those matters as to which the greatest urgency existed.

As it appeared that the office was over-organized in view of the depleted size of the staff, the Land Acquisition Division was inactivated and its functions and personnel were distributed among the remaining divisions of the office. Accordingly, the attorneys and legal functions of the Office of the Solicitor were organized into four divisions, namely, the Public Lands Division, the Indian Division, the Claims Division, and the Legislative Division, during the fiscal year. In addition, the office maintained the Administrative Branch, consisting of the Docket and Records Section, the Law Library, and the employees handling the personnel work and the business affairs of the office.

LEGAL OPINIONS.—The Office of the Solicitor rendered a total of 106 written legal opinions to the Secretary of the Interior and to other principal officials of the Department during the fiscal year 1948. The types of legal problems dealt with in these opinions are illustrated in the examples referred to below:

M–34796: Former tribal land ceded to the United States and presently undisposed of cannot be returned to tribal ownership by the Secretary of the Interior if the particular tribe has voted to exclude itself from the benefits of the Indian Reorganization Act of June 18, 1934.

M–34960: The liability to the United States of an innocent purchaser of timber removed from the public domain by a willful trespasser is determined by the same measure of damages that would be applicable in the case of the trespasser, unless a pertinent State statute establishes some other rule of liability.

M–34978: In the event of actual or threatened drainage of oil or gas from deposits within a national monument by wells drilled on nearby lands not owned by the Government, the Secretary of the Interior has the authority to take the necessary protective action, including the issuance of oil and gas leases with respect to land within the monument.

M–34985: The Mineral Leasing Act of February 25, 1920, as amended, does not authorize the issuance of leases for the development of the oil and gas deposits in the submerged lands below low tide off the coasts of the United States and outside the inland waters of the coastal States.

M–34987: Title to the Wyandotte Indian burial ground in Kansas City, Kansas, is in the United States, subject to its use by the Wyandotte Tribe, and the City of Kansas City, Kans., has no authority over or title to this tract.

M–34989: Section 2 of the act of the North Carolina Legislature of April 5, 1947, purporting to prescribe the qualifications for officeholders in the government of the Band of Eastern Cherokee Indians, is invalid.

M–34990: Attorneys acting for the Ute Indians pursuant to the Ute Jurisdictional Act of June 28, 1938, have the right of access to departmental records notwithstanding their confidential character.

M–35000: Section 4 of the Veterans' Preference Act of September 27, 1944, as amended, accords to veterans of World War II a preference right to homestead unsurveyed lands in Alaska which, upon revocation of a withdrawal, are restored to disposition under the homestead laws.

M–35003: Temporary withdrawals of public lands may be made by the Secretary of the Interior in anticipation of the enactment of legislation reserving such lands for the use of Indian tribes.

M–35011: A "Recess of the Senate," during which the President is authorized by the Constitution to make appointments to positions requiring Senate confirmation, means any substantial period of time when no meetings are held by the Senate and that body is not available to receive communications from the President and to give its advice and consent with respect to nominations.

M–35013: The Nooksack Indians of the State of Washington, for whom no reservation has ever been established and who have never been recognized as a tribe, cannot organize or adopt a constitution under section 16 of the Indian Reorganization Act of June 18, 1934.

M–35017: The Secretary of the Interior is authorized to impose zoning restrictions on privately owned lands in Yosemite and Kings Canyon National Parks.

M–35020: The allocation of the hot water originating in the Hot Springs National Park is discretionary with the Secretary of the Interior, but the Secretary, in exercising his discretion, should give consideration to applicants in the order or priority prescribed by Congress and should apply the standards provided by Congress in passing upon applications.

M–35025: An officer or employee who utilizes public funds for personal service, advertisement, telegram, telephone, letter, printed or written matter or other device with an intent to induce or cause public pressure to be brought upon the Congress with respect to proposed or pending legislation is in violation of the antilobbying law.

M–35026: The Secretary of the Interior has the legal authority to lease to the Boy Scouts of America the camp built by former President Hoover on the Rapidan River in the Shenandoah National Park.

M–35027: Delegations of authority may be made to field officials of the Bureau of Indian Affairs with reference to the approval of the expenditure of tribal funds, the approval of tribal resolutions and ordinances, and the making of per capita payments to the members of Indian tribes.

M–35027A: The President has the power to extend the boundaries of Naval Petroleum Reserve No. 1 so as to include in the reserve, subject to valid existing rights, additional public lands and also privately owned lands.

M–35028: (*a*) The authority to approve contracts between attorneys and unorganized Indian tribes pursuant to section 2103 of the Revised Statutes may be delegated by the Secretary of the Interior to the Commissioner of Indian Affairs; (*b*) the Secretary of Agriculture has the exclusive authority to sell the timber in the Tongass National Forest, including timber growing upon lands with respect to which native groups have possessory rights; and (*c*) the possessory rights of the natives of Alaska were not extinguished by the Treaty of Cession of June 20, 1867.

M–35031: The verb "to fix," as used in that part of subsection (d), section 9, Reclamation Project Act of 1939, stating that the general repayment obligation of a contracting organization "shall be spread in annual installments, of the number and amounts fixed by the Secretary," means to establish definitely, so that the contracting parties know how many installments are contemplated by the contract and how much money is involved in each installment.

M–35033: The position of Governor of Alaska did not become vacant, and the authority of the incumbent to perform the duties of the office did not terminate, upon the expiration of the 4-year term which was begun by the incumbent on March 23, 1944.

M–35034: The requirement in section 1 (d) of the Helium Act of September 1, 1937, that the Secretary of the Interior acquire by purchase all properties developed or constructed by private persons for helium production relates only to a property equipped with a plant and other facilities necessary for extracting helium from helium-bearing gas, and is not applicable to lands developed for the production of helium-bearing gas.

M–35040: The Commissioner of Indian Affairs may appoint traders on the Navajo Reservation and may fix the prices of traders' goods without the consent of the Navajo tribal authorities, but traders must secure the consent of the tribal authorities in order to use tribal lands for their establishments.

M–35042: The Migratory Bird Conservation Commission may determine for itself the extent to which its business shall be transacted at formal hearings or other meetings attended by members of the Commission, and the extent to which the Commission's business shall be disposed of through the device of having its members individually submit written indications of their approval or disapproval of proposals which have been presented to the Commission for decision.

M–35047: The Secretary of the Interior, in embarking upon a program to furnish water for irrigation purposes under section 9 (e) of the Reclamation Project Act of 1939, is not necessarily limited to a 40-year period for effecting the reimbursement to the United States of that part of the cost of the construction of works connected with water supply and allocated to irrigation.

M–35053: "Strategic and critical materials" are those materials which the Secretary of the Army, the Secretary of the Navy, and the Secretary of the Interior jointly determine to be strategic and critical.

Appeals.—On December 9, 1947, the Solicitor received from the Secretary of the Interior a delegation of authority to decide appeals taken by members of the public to the Secretary from decisions of the Director of the Bureau of Land Management, and appeals taken by contractors to the head of the Department from findings of fact or decisions made by contracting officers of the Department. Theretofore, the final decisions in connection with both types of appeals had been prepared in the Office of the Solicitor and then submitted to the Secretariat for consideration and signature, if approved.

During the fiscal year 1948 the Office of the Solicitor disposed of 434 appeals. Some of the more important decisions rendered during the year in connection with appeals are indicated below:

Jack A. Medd (A–23951).—Nonnavigable waters on the public domain which are unappropriated at the time of their inclusion in a public water reserve are not thereafter subject to appropriation under State laws while the reservation of the waters remains in effect.

State of Louisiana (A–24618).—A swampland selection filed by the State of Louisiana was correctly rejected where the State's selection was based on an effort to impeach two prior surveys by the Department as fraudulent surveys and insufficient evidence was shown by the State to warrant treating the surveys as fraudulent.

A. A. Brigman (A–24678).—Where the Government, in patenting former Indian tribal lands that had been ceded to the United States, reserved the mineral rights, and the mineral rights were subsequently restored to tribal ownership pursuant to section 3 of the Indian Reorganization Act of June 18, 1934, the oil and gas deposits in such lands cannot be leased under the Mineral Leasing Act of February 25, 1920, as amended, but they can be leased pursuant to the act of May 11, 1938.

Margaret Stepp (A–25219).—The Secretary's order of September 14, 1948, restoring to the ownership of the Southern Ute Tribe of Indians certain ceded Ute lands in Colorado then undisposed of includes minerals reserved to the United States under patents issued for the surface of the opened lands of that reservation.

Henry Mitchell (A–25337).—Where two applicants who are in competition for a grazing lease have equal preference rights, the land will be awarded on the basis of the land-use patterns, the applicants' equities, their comparative ability to utilize the range effectively and properly, the amount of Federal range necessary to permit the proper use of their respective base lands, and other factors relevant to the purposes of the Taylor Grazing Act.

Lewis C. White (A–25354).—In arriving at the comparative values of the lands involved in a proposed private exchange, current transactions in the sale of real estate in the vicinity of the selected lands and the uses to which the lands may be put are among the elements of value which may be properly considered.

Warner Construction Company (CA–9).—A claim for relief under the War Contracts Hardship Act of August 7, 1946, must be denied where the Department had taken final action upon the claim prior to VJ-day and the contractor had no claim pending before the Department upon that day.

Luther Brothers Construction Co. (CA–19).—The Department is without authority to make an equitable adjustment under a construction contract in order to compensate the contractor for increased costs which the contractor incurred because of the failure of the Government to furnish, in accordance with its obligation under the contract, equipment needed for the performance of the work.

CLAIMS.—On July 23, 1947, the authority to determine the merits of claims for damages arising out of the survey, construction, operation, or maintenance of irrigation works was delegated to the Solicitor. Previously, drafts of proposed decisions in connection with such claims had been prepared in the Office of the Solicitor for issuance by the Secretary, the Under Secretary, or the Assistant Secretaries.

During the fiscal year 1948, the Solicitor continued to exercise the power which had been delegated to him during the fiscal year 1947 for the final disposition of claims under the Federal Tort Claims Act, either in the first instance or on appeal from determinations made by field attorneys.

The Office of the Solicitor disposed of a total of 114 irrigation and tort claims during the fiscal year 1948.

LEGISLATION.—The Office of the Solicitor was called upon to handle during the fiscal year 1948 an increasingly heavy load of work in connection with legislative matters. The upward trend in the volume of this type of work is illustrated by the fact that during the fiscal year 1948 the office drafted or reviewed a total of 869 reports on introduced and enrolled bills, as compared with an aggregate of 614 such reports prepared or reviewed during the fiscal year 1947. The substantial increase in the volume of the legislative work devolving upon the office was rendered especially burdensome by the fact that the Legislative Division had been seriously affected by the reduction-in-force program that became necessary shortly before the beginning of the fiscal year 1948.

Approximately 38 percent of the public laws enacted by the 80th Congress during the fiscal year 1948 were of direct concern to the Department of the Interior. Some of these public laws affecting the Department are listed below:

Public Law 395: To stabilize commodity prices.

Public Law 407: To authorize the Secretary of the Interior to grant rights-of-way across Indian lands.

Public Law 440: To define the boundary of the Uintah and Ouray Indian Reservation, Utah.

Public Law 443: To amend the Synthetic Liquid Fuels Act.

Public Law 447: To authorize the United States Park Police to make arrests within Federal reservations in the environs of the District of Columbia.

Public Law 534: To authorize the acquisition and maintenance of wildlife management and control areas in California.

Public Law 554: To authorize the adjustment of irrigation charges on the Flathead Indian Reservation, Montana.

Public Law 576: To amend the Mineral Leasing Act of 1920 and the Potassium Act of 1927 so as to promote the development of certain minerals on the public domain by increasing acreage limits, etc.

Public Law 593: To expand the authority of the Legislature of Alaska to impose real property taxes.

Public Law 616: To authorize the disposition of surplus property to States, etc., for park, recreational, and historic-monument purposes.

Public Law 790: To establish an emergency fund to assure the continuous operation by the Bureau of Reclamation of irrigation and power systems.

Public Law 795: To establish the Independence National Historical Park.

Public Law 835: To authorize payments to school districts on certain reclamation projects while under construction.

Public Law 854: To authorize the adjustment of irrigation charges on the Fort Hall Indian Irrigation project.

Public Law 855: To continue The Virgin Islands Company as an agency of the United States until June 30, 1949.

SUBMERGED LANDS.—The Office of the Solicitor participated in the negotiations which led to the execution of stipulations between the United States and the State of California (*a*) regarding the ownership of the lands beneath certain bays and harbors on the California coast, and (*b*) regarding oil and gas operations in areas the ownership of which, as between the United States and California, will remain in doubt until the line of demarcation is finally drawn by the Supreme Court between the marginal sea adjacent to California, on the one hand, and the tidelands and inland waters of California, on the other hand.

This office also collaborated in the drafting of a proposed bill to authorize the issuance of leases for the development of the oil and gas deposits in the continental shelf adjacent to the coasts of the United States and Alaska. This bill was submitted to the Congress and was introduced in the House and Senate, but no action was taken upon the measure by the Congress during the fiscal year.

In addition, the office participated in the drafting of a proposed bill to quitclaim to the States the Federal title, if any, in the tidelands (i. e., lands covered and uncovered by the movement of the tides) and in the lands beneath bays, harbors, and other navigable inland waters within the boundaries of the respective States. This proposed bill was submitted to the Congress and introduced in the House and Senate, where it was pending without action at the end of the fiscal year.

PATENT MATTERS.—The Solicitor continued to perform during the fiscal year 1948, pursuant to a delegation of authority from the Secretary of the Interior, all the powers, authority, and discretion of the Secretary with respect to patent policies and procedures within the Department.

A revision of the Department's patent regulations was prepared.

In an effort to promote the use of the patents which have been assigned to the Secretary of the Interior, letters were prepared and mailed to a large number of mining and engineering trade journals for the purpose of transmitting a list of such patents to them for publication.

Court Decisions.—The following summaries indicate some of the more important court decisions that were rendered during the fiscal year 1948 with respect to matters of interest to this Department:

Grimes Packing Company v. *Hynes.*—The United States Circuit Court of Appeals for the Ninth Circuit held that the power to include coastal waters within the exterior boundaries of an Indian reservation in Alaska has not been conferred upon the Secretary of the Interior by Congress, except where the Secretary acts merely to confirm native possessory rights previously established with respect to the particular area of coastal waters. Certiorari was subsequently granted in this case by the Supreme Court at the request of the Government, and the case was pending in that Court at the end of the fiscal year.

West v. *Oklahoma Tax Commission.*—The Supreme Court of the United States affirmed the decision of the Supreme Court of Oklahoma holding that the restricted estates of deceased Osage Indians, including their headright interests but excluding their tax-exempt homesteads, are subject to the Oklahoma inheritance and estate tax laws.

Shade v. *Downing.*—It was held by the Supreme Court in this case that the United States is not a necessary party to a proceeding brought under the act of June 14, 1918, to determine the heirship of a deceased citizen allottee of the Five Civilized Tribes.

United States v. *Board of County Commissioners of Cherokee County, Oklahoma.*—The United States District Court for the Eastern District of Oklahoma held in this case that the service of a notice of the pendency of litigation on the Superintendent of the Five Civilized Tribes made after the expiration of the 10-day period specified in the act of April 12, 1926, was a procedural rather than a jurisdictional defect, and that the United States was bound by the judgment.

Statistical Summary.—The table set out below is designed to provide a statistical summary of the work accomplished by the Solicitor's Office, with the exception of the Legislative Division, during the fiscal year 1948. Figures with respect to the Legislative Division are omitted from this summary because the statistics concerning the activities of that division have been maintained heretofore on a basis different from that used in connection with the work of the remainder of the Solicitor's Office.

	Pending at beginning of year	Received during year	Disposed of during year	Pending at end of year
Cases for review	229	3, 222	3, 249	202
Miscellaneous correspondence	21	3, 584	3, 581	24
Appeals	205	733	434	504
Motions	28	117	127	18
Claims	55	87	126	16
Legal opinions	18	106	106	18
Title opinions	23	5	28	0
Total	579	7, 854	7, 651	782

Division of Territories and Island Possessions

JAMES P. DAVIS, *Director*

Hawaii

HAWAII'S aspirations to statehood met with a temporary set-back, just prior to the adjournment of the second session of the Eightieth Congress. Although enabling legislation for statehood had passed the House of Representatives in the first session, on May 8, 1948, the Senate Committee on Interior and Insular Affairs voted 7 to 5 not to report out the statehood bill. Instead, the committee planned to hold further hearings in Hawaii some time in November. A resolution to discharge the committee from further consideration of the bill was defeated on the Senate floor.

But if no progress was made on the political status front, the advance was considerable in other fields.

Territorial tax collection records reached a new high during the fiscal year, totaling $61,433,503, an increase of $16,445,838 over the previous fiscal year, due in large part to higher income, general excise, and fuel tax rates, and the levying of a new compensation tax. Federal internal revenue tax receipts for the District of Hawaii totaled $107,651,471.35, an increase of $1,785,808.37 over the previous year.

Labor-management relations improved.—The number of work stoppages dropped from 26 to 12, and the total of man-days lost thereby dropped from 1,925,874 during the fiscal year 1947 to 81,535. One hundred seventy-five bargaining contracts, most of which were negotiated during the year, were in force on June 30, 1948.

The deaths from tuberculosis dropped 35 percent during the fiscal year, from 49 (per 100,000 persons) to 37.1. More than 100,000 persons submitted to chest X-rays. A cancer-control program was promoted; a bureau of laboratories was set up in the Territorial Department of Health; three projects under Federal Children's Bureau grants were inaugurated; and regulations relating to working places and working conditions were issued.

The adult education program, started in January 1946, had an enrollment of over 10,000 by the end of the fiscal year. Educational standards throughout the Territory's 187 public schools continued high, although the pupil-teacher ratio was not reduced from the 32–1 proportion of the previous period. Hawaii pays its teachers a higher annual salary than any other State or Territory except New York. The University of Hawaii faced a difficult problem of caring for its students: A registration of 3,800, 40 percent over the prewar enrollment, put a severe strain upon the university's facilities. Despite the heavy enrollment, the pupil-teacher ratio was 17 to 1, the most favorable since 1941.

The dollar value of animal products marketed increased 17 percent over the previous year, while the value of fisheries increased 26.7 percent. Sugar and pineapple crops accounted for most of the 24 percent increase in dollar value of all agricultural crops.

Housing is still a difficult problem in the Territory. It has been estimated that a minimum of 2,083 additional permanent, low-income units are urgently needed in Honolulu alone. Unemployment, too, has become a major problem: A total of $767,339 in unemployment benefits was paid out during the fiscal year, an increase of 122 percent over the preceding period. This is exclusive of payments under the veterans' readjustment program, which also rose sharply.

During the year commercial air lines carried 63,055 passengers between Hawaii and the mainland; surface transportation accounted for 26,000. The Civil Aeronautics Board had before it the question whether to authorize direct service between the Pacific Northwest and Hawaii; the establishment of such service had the Department's endorsement.

Alaska

Alaska's statehood ambition, like Hawaii's, was blocked by congressional action. President Truman twice urged the Congress to enact enabling legislation. The Committee on Public Lands of the House of Representatives, after extensive hearings held in Alaska by one of its subcommittees during the fiscal year, reported favorably on a bill to provide for Alaska's admission into the Union. However, the House Rules Committee refused to issue a rule on the bill, on the ground that Congress had more pressing matters to deal with before adjournment.

Plans for Alaska's development went ahead nevertheless, in anticipation of the time when statehood would be granted. Plans were made for the establishment of a field committee within the Department of the Interior, to integrate the Alaskan activities of various agencies of the Department, and thereby to increase their effectiveness. Represented on the committee would be The Alaska Railroad; the Alaska Road Commission; the Bureaus of Indian Affairs, Land Management, Mines, and Reclamation; the Fish and Wildlife Service; the Geological Survey and the National Park Service. It was contemplated that among the chief duties of the committee would be the formulation of a long-range departmental program for Alaska.

There was also organized an Interagency Committee on the Development of Alaska, at the invitation of the Secretary of the Interior, composed of representatives from all Federal departments and agencies carrying on programs in the Territory. Subcommittees were set up on transportation; housing and community facilities; health, education and welfare; and resource policy. The latter was further broken down into technical subcommittees on agriculture, range and forestry, commercial fisheries, furs and wildlife; mapping, charting and surveying; minerals, including fuel, recreational resources; and water and power resources. The objectives of the committee are to prepare a plan to increase Alaska's population and develop its resources in the interest of the national economy and the national security, and to formulate specific departmental projects within the general plan, to be carried out as rapidly as appropriations will permit.

In February 1948, the Interagency Committee submitted a preliminary report to the President, on the basis of which the President sent a special message to Congress, near the end of the fiscal year, recommending a number of actions designed to contribute to the balanced development of Alaskan resources and to help open economic opportunities on a sound long-term basis. These recommendations included (*a*) statehood for Alaska; (*b*) improvement of the transportation system by assisting in the establishment of a low-cost sea transportation system by the amendment of maritime laws which now discriminate against Alaska, by an acceleration of the rehabilitation program of The Alaska Railroad, by improvement of the existing road system and the construction of new roads, and by the encouragement of air transportation to, from, and within the Territory; (*c*) effective provision for construction of housing and community facilities; (*d*) enactment of legislation providing a means of settlement of the Alaska native claims; and (*e*) amendment of lands laws to facilitate settlement.

Alaska had continued to suffer from inadequacies and high costs in the transportation system throughout the year. Several jurisdictional strikes, though of relatively short duration, tied up essential goods at mainland ports. A rate investigation by the Maritime Commission resulted in no lowering of freight tariffs. Two hopeful signs that the surface transportation monopoly might be broken were the inauguration of barge service between the railbelt, through the Whittier terminal, and Seattle, and proposed establishment of a new steamship service between Portland and the railbelt via the Seward terminal. No headway was made in getting Congress to amend the shipping laws to the extent that they discriminate against the Territory.

Better progress was made on other parts of the transportation system. The Alaska Railroad's rehabilitation program moved along, with the railroad making good use of its contractual authority to improve its roadbed and the condition of its rolling stock and of its special authority to acquire surplus equipment from other Federal agencies without cost. Two international civil airports were authorized by Congress, one at Anchorage and one at Fairbanks, and funds were appropriated for their construction. The program of the Alaska Road Commission was substantially expanded, and its administrative set-up revised; the position of Commissioner of Roads for Alaska was created by Secretarial order, and negotiations were begun with the Public Roads Administration looking to the construction of a road linking the Kenai Peninsula to Interior Alaska. The road commission, like the railroad, was given authority to acquire surplus equipment from other Federal agencies without cost.

Housing was a serious obstacle to complete success of development plans. The severe shortage of any kind of dwelling discouraged permanent settlement, and made it impossible for persons engaged to work in Alaska to bring their families with them. Alaska was particularly hard hit by the failure of the Eightieth Congress to enact general housing legislation, which presumably would have included the Territory; no action was taken by the Congress on a bill applicable to Alaska alone. Legislation authorizing a program of public works, to be carried out by the Federal Works Agency, was presented to Congress near the end of the second session, and no action was taken thereon. The bill will be reintroduced in the Eighty-first Congress. It would provide for schools, hospitals, public utilities, harbor facilities, etc.

The problems of aboriginal rights, insofar as they tend to impede industrial development in southeastern Alaska, were temporarily put in abeyance by the enactment, on August 8, 1947, of the Tongas Timber Act (Public Law 385, 80th cong., 1st sess.), which authorized the Secretaries of Agriculture and Interior to sell timber and lands in the national forests to individuals and commercial enterprises, the proceeds from such sales to be held in escrow in the United States Treasury until the native land claims have been determined by the Congress or other competent authority. The money so set aside may be used to compensate the natives if it should later be determined that their claims are valid. Private industry will therefore be less reluctant to enter the timber regions, since the natives will look to the escrow fund, rather than to the purchasers of the land or timber, for indemnity.

Encouragement was given to the establishment of small industries and to new settlers by the revocation of the land withdrawal along the Alaska Highway, which opened to public entry an additional 2,750,000 acres. There is urgent need of establishments to serve the tourist and freight traffic along the highway, which connects Alaska to the States, and the opening of the lands to entry was designed to encourage the establishment of tourist lodges, auto camps, service stations, restaurants and the like.

Puerto Rico

At the close of the fiscal year, Puerto Ricans were looking forward to the nominating conventions, at which candidates for Governor would be named by the various political parties. The election, to be held at the same time as the election in the continental United States, would be the first at which Puerto Ricans could elect their own Governor.

Puerto Rico placed special emphasis on the encouragement of private industry and the development of tourism as a source of income. Efforts to develop other sources of revenue were spurred on by the continuing drop in internal revenue tax receipts due to the poor state of the rum market. Another law granting tax exemption to new industries, including hotels, until June 30, 1962, was enacted by the insular legislature. The exemption, in certain cases, extends to dividend or profit distributions made by an exempt entity. A tourism advisory board and an office of tourism were established to develop tourist facilities and to publicize Puerto Rico's attractions.

A crucial factor in the success of any tourism program for Puerto Rico is air transportation. The air transportation picture looked brighter than it had during the previous fiscal year. The transportation authority, an agency of the insular government, took over the operation of all civil aviation facilities. Work was begun on a new terminal building, to take care of the thousands of passengers that daily pass through the international airport at San Juan. All preliminary studies for the development of the Isla Verde International Airport were completed; this airport is expected to supplant the airport at San Juan.

The disproportion of population to available land continued to be a major problem confronting the insular government. The employment and migration service was thoroughly reorganized to enable it to do a more effective job of finding employment opportunities both within and outside Puerto Rico. An apprenticeship division was created in the service to train workers. Orientation courses given to prepare women for domestic service have been particularly successful. Groups of such trainees have been placed in several cities on the mainland. Farm laborers have also been supplied for seasonal work in several States.

The appearance of considerable periodical and newspaper publicity on the mass migration of Puerto Ricans to New York City, emphasizing the crowded and unsanitary conditions of their life there and alleging that the Puerto Ricans swelled relief rolls very soon after their arrival, led the government of Puerto Rico to commission Columbia University for a report on the situation. The study indicated that the total number in the Puerto Rican colony in New York is somewhere between 160,000 and 200,000, a figure well below the 500,000 which figured prominently in the newspaper reports. The study also contained information with respect to incomes, ages, origins, contributions to families back in Puerto Rico, which will prove very helpful to the insular government, New York City officials and private and public welfare agencies in New York City and in the island.

Another aspect of the employment placement program was the department of education's intensification of the English-language teaching program, and the initiation of a thoroughgoing study of the public-school system with the object of more effectively utilizing human and material resources. Enrollment in schools, public day and evening and private, totaled 435,355, an increase of 7.07 percent over the previous fiscal year. Veterans' enrollment in the public schools was 491 percent over the previous year's enrollment.

The financial condition of the insular government continued good, although revenue collections for the general fund totaled something over $1,000,000 less than during the previous year. Among the important measures enacted by the Legislature of Puerto Rico were amendments to the election and registration law, to insure the greatest protection of the franchise and equality of rights to all political parties; amendments to the insurance law; measures to provide educational facilities for veterans, to establish and regulate credit unions, and to determine the policy of the insular government with respect to migration. Funds were appropriated to carry out a program of public improvements, with emphasis on the construction of hospitals, medical centers, public-health units and schools, both in the urban and rural districts.

Sugar production during the fiscal year amounted to 1,065,280 tons; 197,215 tons of cane sugar were refined. A strike in mainland sugar refineries caused a storage problem in the island, and the Division's aid was enlisted in obtaining temporary use of Federal warehouse space. There was also a possibility that rationing of fuel oil might have to be instituted to assure uninterrupted cane grinding and power generation, because of a threatened fuel-oil shortage. When the oil was made available commercially, the Division was called on to arrange with the Maritime Commission for the chartering of a tanker to transport the oil to Puerto Rico.

Virgin Islands

The Virgin Islands sought no change in political status during the year, although the Organic Act Reform Committee was still active in the islands, and was making plans for a plebiscite in connection with the next election. No action was taken by Congress on the proposed resident commissioner bill.

The islands were, however, casting about for some way to improve their financial status. The budgeted expenses of the local government for the fiscal year amounted to only $1,422,626.23, as against $1,523,-651.18 for the previous year, and yet the revenues collected from taxation amounted to only $1,087,056.02. Congress provided a deficit appropriation of $140,000, but even with this grant the funds available were insufficient to maintain essential government services at an acceptable level. In an effort to find a more than temporary solution to the problem, the Department and the Virgin Islands government asked Congress to enact legislation authorizing the covering into the treasury of the Virgin Islands the proceeds of the internal-revenue tax on Virgin Islands products now covered into the Federal Treasury. Precedent for the plan was found in Puerto Rico which for many years has had covered into its treasury the proceeds of such taxes on Puerto Rican products. But although the Senate passed the bill, the House Ways and Means Committee refused to take any action on it.

The Virgin Islands Company, which operates federally owned sugar properties and a rum distillery, and provides employment for about 1,000 persons during crop time and half that number during the rest of the year, was itself in a difficult financial position. Under the Government Corporation Control Act of 1945, the Company, established under a municipal ordinance in the Virgin Islands, was required to obtain a congressional charter before the end of the 1948 fiscal year. Congress was presented with a bill which would have granted such a charter and would have reorganized and expanded the Company's activities so as to make it a more effective instrument for the development of the islands' economy; it would have been authorized to undertake an extensive program of tourist development, water and soil conservation, and to encourage agriculture, industry and commercial enterprises. The bill failed to pass, however, and it was only just prior to the adjournment that the Company was authorized to continue present operations for the next fiscal year, and to borrow $500,000 from the Treasury. Although the Company had produced 4,350 tons of sugar, 1,400 more than the year before, the money-making aspect of its activities has always been the rum operation. This was severely restricted in the 1948 fiscal year because of the continued inactivity of the rum market. Operations of private distillers were equally curtailed: only 120,730 proof gallons of alcoholic beverages were exported from St. Thomas as compared to 244,809 proof gallons the previous year.

The unfavorable trade balance of the islands has added to the difficulties of the local economy. During the calendar year 1947 goods valued at $9,031,743 were imported by the islands, while the value of exports was only $2,183,744. Efforts to correct this situation have been directed mainly at the production locally of more food products, sufficient not only for local needs but also for export. Under sponsorship of the Government agricultural station, 26,000 pounds of tomatoes were sent from the islands, by air, for sale in the winter markets of the continental United States. The experiment was sufficiently profitable to local growers to encourage a much larger planting of vegetables for export during the 1948–49 winter season.

There was considerable progress in the field of tourism and related real-estate activity. The Holland-American Line planned a cruise itinerary to take in St. Thomas. This will be in addition to regular ALCOA service, and the three cruise ships that called at the islands last year. One hotel in St. Thomas and two small ones in St. Croix were completed and placed in operation. Ground was cleared in St. Thomas for the construction of another large hotel and 25 resort cottages. The Department was considering advertising for proposals for the expansion of Bluebeard's Castle Hotel at St. Thomas. A number of old estates were brought by individuals, some to be rehabilitated for personal use and others for development and resale. The municipality of St. Thomas and St. John acquired, from the Department, use of the deactivated naval and marine corps facilities, and set about making the property available for tourism projects and community facilities. All of these activities make for increased employment opportunities, and will in the future bring increased revenues into the local treasuries.

The municipality of St. Croix took over from the Army the operation of the airport at Benedict Field. Pan American Airways applied to the Civil Aeronautics Board for a certificate to service St. Croix, thus linking it with Pan American's routes to the mainland and South America. Benedict Field can take the largest planes in use now, and favorable action on the application would put St. Croix in a very favorable spot in the international air traffic scene. The municipality of St. Thomas and St. John took over the operation of the airfield on St. Thomas, already served by Pan American and Caribbean Atlantic Airlines.

The government of the Virgin Islands conducted a general program of immunization against typhoid fever, with the cooperation of the Division which secured the necessary vaccine without charge. Congress extended to the islands title VI of the Public Health Service Act, making them eligible for allotments for hospital construction and facilities. A veterans' education program was established in the islands, including courses in elementary education and secondary subjects; nearly 300 veterans are enrolled. The municipality of St. Thomas and St. John also made provision for the payment of transportation of veterans matriculating in the States, and set up small scholarships for vocational training in the States. A juvenile aid bureau was established in St. Thomas to assist in combating delinquency.

Pacific Islands

On July 18, 1947, President Truman signed Executive Order No. 9875, terminating military government in the former Japanese mandated islands, now the Trust Territory of the Pacific Islands, and placing responsibility for civil administration thereof in the Navy Department, on an interim basis. The Department of State, pursuant to a report submitted to the President in June 1947 by the Secretaries of State, War, Navy, and Interior, prepared draft organic legislation for the Trust Territory. This was submitted to Congress on May 10, 1948, but Congress took no action with respect to it.

The Navy Department completed its draft of organic legislation for American Samoa, but, although cleared by the Bureau of the Budget, the bill was not submitted to Congress by the Navy prior to adjournment. Organic legislation for Guam had been submitted to the first session of the Eightieth Congress by the Departments of Navy and Interior, jointly.

It appeared likely that all draft organic legislation for the Pacific islands submitted by executive departments of the Government would be shelved by Congress in favor of legislation drafted by congressional committees. The Cordon Resolution (S. Con. Res. 37) introduced on December 19, 1947, established a joint committee to study all the Pacific islands under United States jurisdiction and to recommend to the Congress such legislation as might be necessary to establish civil government in the area. The accompanying statement set out the Senator's conviction that primary responsibility for the preparation of such legislation lies with Congress. A brief hearing was held in Washington and members of the joint committee made plans to visit the islands early in November.

By letter of February 11, 1948, the President directed the Interior Department, through the Division, to proceed to make plans for the administration of the Pacific islands. The President stated that it was his intention to transfer responsibility for such administration to the Department upon the enactment of organic legislation. The committee of the four Secretaries had recommended to the President that transfer of administration be made at the earliest practicable date.

Congress enacted a bill which extended the jurisdiction of the United States District Court for Hawaii to Canton and Enderbury Islands. These islands have been claimed by both the United States and Great Britain, who agreed in 1939 to place their sovereignty claims in abeyance and to administer the islands jointly. During the war, no attempt was made to work out details of joint administration, but since the war the aviation facilities on Canton, which derives its importance from its strategic location as a way-station on trans-Pacific flights, have been expanded. The presence of civilian CAA employees and employees of Pan American Airways made it important that some provision be made for law and order, such as exists in any community. Work was done by the Division on a draft proposal to be submitted to the British through the State Department, and to serve as a basis for negotiations on the details of administration, the establishment of courts, the provision for appellate review of judgments, the definition of crimes, and the application of tort and other law.

Puerto Rico Reconstruction Administration

JAMES P. DAVIS, *Administrator*

OPERATIONS that differ little in essentials from those of the previous years were financed with allotments out of the Puerto Rico revolving fund for projects approved by the President, as follows:

Operation and maintenance of housing projects	$298,100
Management and operation of federally owned lands at Lafayette	7,900
Operation of Castaner Farm project	51,000
Servicing of loans to cooperatives	40,000
General administration	[1] 216,600
Operation of central service farms	74,000
Total	687,600

[1] Includes $41,400 allotted solely for the liquidation program.

The plan for continued liquidation of this Administration in an orderly fashion provided for the transfer of the supervision of the rural and urban housing units to the Public Housing Administration and a transfer of the loans and notes receivable to the Farmers Home Administration. Both of these agencies declined to accept such transfers and as a result, the loans and notes receivable are being liquidated as rapidly as possible by this Administration and both individual rural and urban housing units are being sold to the present occupants.

Receipts from the housing units and sale of lots at the Eleanor Roosevelt and Morell Campos developments exceeded maintenance and operation expense by approximately $400,000. As of June 30, 502 urban and 7,171 rural month-to-month rental agreements had been converted into long-term leases with option to purchase, 572 units had been conveyed and title vested in rural and urban tenants, while under the liquidation program, 416 urban and rural units were sold under the deed-mortgage plan during the year and the Falansterio Apartment building, comprising 216 units, was sold to the tenants operating as the Cooperativa de Inquilinos del Falansterio under insular law.

As in previous years, although on a greatly reduced basis, Central Service Farms continued to assist needy resettlers in the raising, harvesting, and marketing of subsistence crops by furnishing seeds, fertilizers, and expert advice until the latter portion of the fiscal year when the major of these Central Service Farms located at St. Just, La Plata, Zalduondo, and Vieques projects were sold under the liquidation program to the Episcopal Church, the Menonites, the American Missionary Association, and the Methodists, respectively. The Castaner Farm produced approximately $1,500 in excess of operating cost from the sale of diversified crops and continued to furnish employment to members of more than 200 resettled rural families.

The conflict between the obligations of PRRA financed cooperatives under their contracts with the Federal Government and interpretations of the new insular cooperative reorganization law were solved and all cooperatives with the exception of the "Cooperativa de Vegetales La Plata" were reorganized under the new cooperative law with the contractual rights of the Federal Government fully protected.

Loans were made to the Jayuya and Corozal Cooperatives in the amounts of $5,250 and $4,000, respectively, for the purchase of shipping materials and were duly paid. During the year payment in full of all loans made by the Federal Government was effected by the Barranquitas and Villalba Cooperatives. In addition, three cooperatives, namely, Cooperativa Central, La Plata, and Cidra are being liquidated, the first two under the insular inspector of cooperatives and the latter by foreclosure action in the Federal court.

The sugar cooperatives Lafayette and Los Canos had very successful years, grinding respectively 281,805 and 247,305 tons of sugarcane, producing respectively 34,751 and 28,588 tons of sugar. The tons of cane ground and the yield obtained establishes an all time record for Los Canos. Both cooperatives are granting a substantial bonus to their members due to their successful activities and the resulting financial income.

Meanwhile, essential projects for the fiscal year 1949 are being continued with allotments aggregating $715,000 out of the revolving fund. That fund derived exclusively from PRRA operations had a net available balance on June 30, 1948, of $2,896,233.

Division of Geography

MEREDITH F. BURRILL, *Director*

ESTABLISHED by Department Order No. 2437 on June 17, 1948, to discharge the duties of the Secretary of the Interior under the act of July 25, 1947, the Division of Geography also performs all staff functions for the Board on Geographic Names and its committees.

The Division investigated and made recommendations to the Board for decisions on 2,146 names; drafted policies, procedures, and directions for treatment of geographic names in individual countries or regions; analyzed linguistic problems; edited 114,701 map and intelligence names; processed 87,672 new standard names; and answered 5,488 requests for correct names, spellings, identification, location or related data.

More than 46,000 cards were punched for the first of a series of gazetteers of official standard names with cross-referenced variant names and spellings, to be made by a tabulating machine process.

Little was done with domestic names because of national security needs and dependence upon working funds. A more balanced program is required to standardize all names and reduce duplication as now required by law.

UNITED STATES BOARD ON GEOGRAPHIC NAMES

This Board which was established by the act of July 25, 1947, replaced the United States Board on Geographical Names, convened on September 15, with the statutory representation. The Department of the Air Force and the Central Intelligence Agency were immediately added. Functions were assigned to an executive committee and standing committees were established on foreign names, domestic names, and publications. J. B. Hutt, representing the Department of the Navy, was named Chairman.

During the year, the Board developed procedures and reexamined basic policies. Arrangements were developed for close cooperation with comparable British and Canadian agencies.

The Board issued 2,161 name decisions, 9 sets of directions for specific countries, and made many policy and procedure rulings.

An Advisory Committee on Antarctic Names continued the work of the former Special Committee on Antarctic Names, recommending decisions and assessing new evidence, and cooperating with American Antarctic expeditions.

Division of Budget and Administrative Management

Vernon D. Northrop, *Director*

THE DEPARTMENT'S budget for the year was reduced initially by the Congress by more than one-third—from 296.1 million dollars to 194.6 million dollars. During the year, however, an additional 64.7 million dollars was made available in supplemental appropriation acts, increasing the Department's total appropriations to 259.3 million dollars. Notwithstanding the supplemental appropriations, most of the Department's operations were financed at a rate far below that for the previous year because most of the increases applied only to the Bureau of Reclamation.

The staff engaged in budget work concentrated its attention on the examination of estimates of appropriations required to attack the backlog of maintenance and repair work which had been deferred and postponed during the war. In addition, the staff examined a record demand for appropriations to continue the public works programs being prosecuted by the bureaus. As a result of these essential budget presentations, the Department has received increased appropriations for these purposes for next year.

The finance work of the Division continued to be directed toward the establishment of a uniform financial reporting system. Accounting and fiscal problems involving the Geological Survey, Bureau of Reclamation, and Bureau of Land Management received special consideration. There was initiated during the year a comprehensive study of accounting and financial reporting procedures in the Bureau of Reclamation in cooperation with the Bureau of the Budget, the Treasury Department, and the General Accounting Office. The General Accounting Office is also cooperating with the Division in a study of collection procedures in the Bureau of Land Management. The finance unit assisted in the installation of simplified and uniform payroll procedures in the bureaus and centralized control in connection with the retirement fund.

In the field of organization and methods, the Division served as the liaison office with the Commission on Organization of the Executive Branch of the Government. In this capacity, the Division directed the work within the Department involved in obtaining numerous and voluminous reports and data requested by various study groups performing staff work for the Commission. In several instances the Division prepared Department-wide statements and summaries for these study groups. In addition, management planning assistance was rendered to bureaus and offices, particularly to the Bureau of Land Management in putting its plans for reorganization into practice.

During the year the Office of Field Representatives, which operated under the direct supervision of the Secretary, was transferred to the Division and its organizational title was changed to the Branch of Investigations. Procedures have been developed to strengthen the investigative work in the Department, including the requirements for uniform reporting and investigation of specified types of cases by the Office of the Secretary. During the year, the Division directed the investigation of significant cases of reported irregularities involving the performance of official duties by employees of the Department. The investigative reports and recommendations of the Division for administrative or other action furnish the Department with the essential facts needed to make proper disposition of such cases.

Under the direction of the Division, the liquidation of former war agencies in the Department was brought to a conclusion, and the War Agency Liquidation Unit was abolished. The liquidated agencies included the Solid Fuels Administration for War, the Coal Mines Administration, the War Relocation Authority, and the Civilian Food Defense program. In addition, the Division completed the liquidation of the Office of the High Commissioner for the Philippines.

Division of Personnel Supervision and Management

MRS. J. ATWOOD MAULDING, *Director*

THE FISCAL year 1948 has been marked personnel-wise by unstable conditions because of (1) drastic reductions in personnel at the beginning of the year as a result of curtailed appropriations, with their attendant placement problems; (2) the continuation of large numbers of temporary appointments because of the absence of civil service registers of eligibles for many positions; and (3) the limitation placed by the Congress on the amount to be spent on personnel work in this Department which had the effect of curtailing personnel programs at a time when placement problems were particularly acute, and forcing certain inescapable personnel functions into the hands of operating employees often untrained to handle them. The unstable conditions had their effect on morale but efforts during the year toward stabilization have improved this situation somewhat.

Shortages of geologists, engineers, chemists, engineering and scientific aides continue to exist. For these positions the Department is in keen competition with private industry, which can pay higher salaries and can engage to a greater extent in direct recruiting at the colleges. Doctors and nurses for the Indian Service are also in short supply. The Civil Service Commission while increasing its coverage under permanent civil-service procedures has not been able to extend its examination program to all fields of employment; the Department is operating committees and boards of examiners for certain positions peculiar to the Department but because of limited funds for this purpose has not been able to participate to the extent that is in the best interest of the Department. The necessity for making temporary appointments has been a deterrent to recruitment. At the close of June 30, 1948, there were 11,535 war service, indefinite, and interim employees on the rolls, which is considerably above normal.

This year saw the practical completion of the objective of delegation of appointing authority in personnel actions to the bureaus under established policies, standards, and procedures. This has made for more effective personnel administration but unfortunately the limitation on Department funds to be expended for personnel work has left many of the bureaus far below an effective strength to carry on their full responsibilities. As a corollary to delegation there was established in the Division of Personnel Supervision and Management a Branch of Inspection to assure that the delegation of authority was being discharged properly and at the same time to assist the bureaus in meeting the standards.

The Classification Branch has made progress on its standards and specifications program and within staff limitations will meet the increasing need for area classification surveys in the field to maintain uniformity among the bureaus and a consistent salary structure. Rates of pay for ungraded personnel have been under constant survey and adjustments made to local prevailing levels as rapidly as substantial evidence was obtained.

Emphasis on supervisory training has continued this year and a successful forum is going on which it is expected will be repeated in the bureaus. The Department has long subscribed to the thesis that competent supervision is the foundation upon which successful management must stand.

There were 307 retirements during the year, of which 47 were for age, 161 optional, and 99 for disability.

At the close of the fiscal year the total number of compensated employees was 56,193, of which 4,190 were in the Washington, D. C., metropolitan area and 52,003 located in the field. Of the total number, 34,407 are classified by grade under the Classification Act, 18,694 under wage board procedure, and 3,092 employees of various classes are ungraded. Veterans in the Department now number 22,288. The number of women is 10,292.

During the year the Director of Personnel served as a member of the Federal Personnel Council, as a member of the Department Board of Awards, and as Secretary to the Department Loyalty Board.

Interior Department Museum

H. L. Raul, *Museum Curator*

THE Interior Department Museum completed its first decade of activity during the fiscal year, 1948. Dedicated on March 8, 1938, it began immediately to take its place among the important attractions in the Nation's Capital. It has been visited continually by tourists, students, and the general public.

Constant effort has been made to increase its services in visualizing the history, aims, and current activities of the Department. The museum has proved to be a valuable instrument in public relations through direct personal contact of each visitor with the vast and varied activities of the Department.

Attendance and Foreign Visitors

Museum visitors during the past year numbered approximately 37,000 persons. Visitors were recorded on the visitors' register from every State in the Union, with the single exception of Delaware, and from Alaska, Canal Zone, Hawaii, and Puerto Rico. Foreign registrations were from Argentina, Australia, Belgium, Bolivia, Brazil, British West Indies, Canada, China, Colombia, Cuba, Czechoslovakia, Denmark, Dutch Guiana, England, Ethiopia, France, Greece, Guatemala, Hungary, India, Iran, Mexico, Netherlands, New Zealand, Norway, Palestine, Poland, Republic of the Philippines, Scotland, Switzerland, Tibet, Turkey, Union of South Africa, Uruguay, and Venezuela.

SPECIAL EXHIBITS

A loan exhibit of unusual interest was installed in the Indian gallery consisting of an elaborate silk garment, presented to Secretary Krug by the Seminole Indians of Florida upon the occasion of the dedication of Everglades National Park, December 6, 1947.

A departmental exhibit was assembled for display in the "Salute to the United States Government Departments" shown by a Washington department store.

The museum prepared a special exhibit—"Rededication of Freedom: The American Heritage" which was held in conjunction with the visit to Washington of The Freedom Train.

A loan exhibit from Mrs. Mary Dorsey Adams, consisting of five water-color paintings by James Madison Alden, who was a member of the Commission of 1848 appointed in connection with the Washburn Treaty between the United States and Great Britain to decide the boundary line between the United States and Canada, along the forty-ninth parallel. The Alden paintings are considered to be the first pictorial recordings made in the primeval area indicated.

COLLABORATION WITH BUREAUS

Throughout the year work has been in progress that has resulted in many changes and additions to the various bureau displays.

A large plastic hermetically sealed display case, installed by the Bureau of Mines, attracts attention as a feature new to museum display equipment.

COOPERATION WITH OTHER AGENCIES

Services in consultation and assistance in display programs and visual education techniques were rendered, upon request, to a number of agencies including Congressional Library; International Delegation of University Women, Toronto; National Archives; Oklahoma Agricultural College; Smithsonian Institution; State Department; Treasury Department; and the University of Michigan.

Yale University photographed the "Geologic Time" exhibit for use as an illustration in a new text book on historical geology.

SCHOOL CLASSES AND ORGANIZATION GROUPS

Many school and college classes visited the museum during the year in connection with their history and scientific courses. These classes were given guided tours through the museum. A good example of continued student interest is shown by the Havre de Grace (Maryland) Junior High School students who made their usual annual trip in school buses.

By request, the museum was held open for an evening class of students from George Washington University to study the geology and mining exhibits pertaining to their course in economic geography.

Approximately 300 delegates to the Navy Scientific Congress visited the museum on November 18.

Special groups, sponsored by letters from members of the United States Senate have been given guided tours.

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